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**The Relationship between Child Marriage and Female
Educational Attainment in India**

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The Relationship between Child Marriage and Female Educational Attainment in India

Khushi Duggal*

Abstract

Child marriage remains a prevalent practice in many countries around the world and can detrimentally affect various life outcomes for young women and girls. Using data from the India Human Development Survey (IHDS-II), this paper explores the relationship between early marriage and the educational attainment of Indian women. The study uses age of menarche as an instrumental variable to isolate the causal effect of marriage timing, with results indicating that each additional year that marriage is delayed is associated with 0.32 additional years of schooling and a 1.9 percentage-point increase in literacy. The findings highlight the lack of regulation of current marriage laws and the need for stringent enforcement, rather than the Indian government's current aims to increase the legal age of marriage for women further. In addition, this study also conducts heterogeneity analysis to determine the possible benefit of this policy recommendation across different residence types, as well as estimates the effect of marriage timing on secondary outcomes.

JEL Classification Codes: I21, J12

Keywords: Child marriage, Early marriage, Education, Schooling, India

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Appendix:

<https://www.dropbox.com/scl/fi/sofp5uq5ahoy6ctd64bqa/Appendix.docx?rlkey=q94xhtcegbqhtml2ogewz7xy3p&dl=0>

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1 Introduction

Child marriage is defined as any formal or informal union where one or both parties are under the age of 18 (UNICEF, 2014). Driven by poverty and social norms, the practice disproportionately affects girls, with the total number of child brides standing at 12 million per year (UNICEF, 2022). Early marriage has detrimental effects on a girl's education, labour market outcomes, psychological well-being, and physical health (Nour, 2006). On a wider note, these individual effects result in much larger social and economic consequences for the developing world, as countries with a high incidence of child marriage experience lower consumption, productivity, per capita earnings, and private and public expenditure (Wodon *et al.*, 2017). Although efforts to end this violation of human rights have increased over recent years, reaching the global aim to end child marriage by 2030 will require a significant acceleration in progress (*ibid.*).

Using IHDS data, this paper attempts to investigate this issue in India, where the prevalence of child marriages remains high despite the existence of age-of-consent laws. More specifically, it aims to estimate the effect of early marriage on educational attainment, an important determinant of an individual's life outcomes. This relationship is complex due to the issue of endogeneity. Hence, existing papers in this field have employed an instrumental variable (IV) strategy to estimate the causal influence of marriage timing on schooling attainment, as well as on other adult outcomes. This study follows the approach posited by Field and Ambrus (2008), whereby women's age of menarche is used as an instrumental variable. As many young girls around the world are withheld from marriage until they show signs of physical maturation, menarche acts as a barrier to prepubescent marriages. The IV results presented in this paper indicate that for each year marriage is delayed, completed years of schooling and adult literacy increase by 0.32 years and 1.9 percentage points respectively. Additionally, this relationship is found to be strongest amongst those living in non-metropolitan urban areas and more developed villages.

2 Literature Review

Early marriage limits the agency of young women, preventing them from making their own decisions about education continuation. Maertens (2013) shows that the socially acceptable age of marriage in rural India significantly constrains the desired education for daughters, with only 39% of girls having parental permission to pursue higher education. A qualitative analysis of this relationship finds that in most cases, unsupportive in-laws and husbands are the decision-makers regarding a girl's continuation of education (Raj *et al.*, 2019). Domestic and maternal responsibilities also restrict access to education, even in cases where post-marriage education was supported (*ibid.*).

Research shows that education cessation due to early marriage is one of the main channels for poor social development and economic outcomes, as inadequate access to schooling limits girls' employment opportunities and acts as a barrier to entry into formal and paid work (Grown *et al.*, 2005; Khanna *et al.*, 2013). For instance, Rabi (2014) estimates that the cost of child marriage in Nepal is 3.87% of GDP, due to educational deprivation and consequential labour market outcomes. Moreover, uneducated women are often considered incapable of participating in important financial decisions in the household. (Becker *et al.*, 2006; World Bank, 2012). Curtailing education at a young age also restricts girls' access to healthcare information and services (Raj, 2010; Santhya *et al.*, 2010). Therefore, choices surrounding the well-being of women and their children are often left in the ill-informed hands of household decision-makers (Parsons *et al.*, 2015). This leads to lower reproductive and physical health outcomes for women and leaves them with very little bargaining power in their marital home. As such, young brides are often isolated, incapable of finding social support, or speaking up against any emotional or physical abuse they may face within their homes. Dhamija and Roychowdhury (2021) find that a delayed marriage causes a significant decline in physical violence in India, and provide suggestive evidence that older, more educated brides are more likely to marry men with higher levels of education. Education cessation is also shown to have various adverse intergenerational effects. Studies suggest that delaying women's marriage in India positively affects children's health and educational outcomes (Chari *et al.*, 2017), as well as their human capital (Sekhri and Debnath, 2014). Furthermore, as the children of child brides are more likely to be married at a young age, the institution of child marriage continues to

subsequent generations, further perpetuating poverty and inequality among communities (Parsons *et al.*, 2015).

Quantitative analysis of the impact of age at marriage on educational attainment is difficult due to endogeneity. As lack of education is also a risk factor for child marriage, the bi-directional nature of the relationship may give rise to reverse causality. (Klugman *et al.* 2014; Wodon *et al.*, 2017). There also exists the risk of omitted variable bias when unobservable factors are not controlled for. These may include a girl's academic ability, gender roles in society, and cultural expectations (*ibid.*). Poverty may also be an issue, as some parents may not be able to afford schooling (Khanna *et al.*, 2013). In such cases, marrying off a daughter early may lessen their economic burdens, especially as the dowry paid to a boy's family often increases with age (ICRW, 2013). Poor education quality and academic opportunities could also be a factor leading to both education cessation and early marriage (Wodon *et al.*, 2016).

One approach to assess the impact of age at marriage on educational attainment is through analysing responses to survey questions regarding reasons for terminating education. A study by Lloyd and Mensch (2008) uses Demographic and Health Survey (DHS) data from five African countries. They find that the cumulative risk of school departure associated with marriage ranges between 12% in Togo and 22.2% in Cameroon, depending on the estimation technique used. However, the paper notes that some results may be overestimated, and the authors question the validity of the survey responses. Nguyen and Wodon (2017) use similar data, concluding that child marriage and adolescent pregnancy account for 15% to 20% of secondary-level dropouts in Nigeria. Sekine and Hodgkin (2017) observe this relationship in Nepal using MICS data, finding that the risk of dropping out for married girls in Nepal is 10 times higher than it is for those unmarried. However, endogeneity remains an issue in these papers.

The second approach uses IV estimation. To take socio-economic and cultural factors into account, Delprato *et al.* (2015) employ three community-level instruments: past age of marriage, proportion of non-premarital sex, and total fertility rate. Using DHS data for 36 countries, they find that a one-year delay in marriage is associated with an increase of half a year of education in Sub-Saharan Africa and almost one-third of a year of education in South-West Asia. In the latter region, a one-year delay in marriage also suggests a 5.5% lower likelihood of secondary-level drop-out. However, the results are only significant for some

regions of Sub-Saharan Africa. The paper also notes that the instruments are not strictly exogenous, and results show conditional statistical correlations rather than causality.

Nguyen and Wodon (2015) employ an alternative strategy, using measures of child marriage at the level of the primary sampling unit (PSU) in which a girl or woman lives, as these instruments are likely to strongly affect age at marriage, but not their educational attainment. Using DHS data for 27 countries in Sub-Saharan Africa, they conclude that each additional year of early marriage reduces the probability of secondary school completion by 3.5 percentage points, as well as the probability of attending secondary education by 5.6 percentage points. This study is extended by Wodon *et al.* (2016), who use four different approaches to estimate this effect in Uganda. Robust results show that child marriage has a significant negative effect on educational attainment. Furthermore, the younger the age at which a girl marries, the larger the negative effects.

Finally, Field and Ambrus (2008) identify a two-stage IV model using age of menarche as an instrument for marriage timing. The paper provides evidence showing that the onset of menstruation affects schooling through marriage decisions, rather than through a direct effect, which validates the use of the instrument. The study shows that for each additional year that marriage is delayed, time spent in school increases by 0.22 years and adult literacy by 5.6%. The results of this paper seem robust, as issues of endogenous instruments, recall bias, and selective mortality are considered.

In conclusion, few papers have been able to estimate a causal effect due to the complexity of the relationship. Furthermore, several of the works are cross-country studies and therefore struggle to acknowledge sociocultural differences. Using a different dataset and an estimation strategy based on that of Field and Ambrus (2008), this study focuses on the relationship between age at marriage and educational attainment in India. This paper sets itself apart from the existing literature by conducting heterogeneity analysis between residence types, as well as analysing the mediating effect of education on secondary individual outcomes.

3 Data and Methods

3.1 Setting

India was selected as the setting of this study due to the availability of data and the high incidence of child marriage in the country. Despite the practice being illegal since 1978, approximately 11.9% of women aged 20-24 in India were married before the age of 18 (Young Lives, 2018). The prevalence of the practice varies across the country, with 12 Indian states showing higher rates of child marriage than the national average (ibid.). There also exists a significant urban-rural disparity in the occurrence of child marriage in India, with over 70% of child marriages in 20 states taking place in rural areas (ibid.). Though the gender gap in education has fallen in recent years, there remains an urban-rural divide in schooling completion and literacy rates, particularly for girls.

The legal age of marriage has been a disputed topic under Indian law since the introduction of The Child Marriage Restraint Act of 1929. Several amendments to this act have led to its most recent revision, The Prohibition of Child Marriage Act of 2006, which increased the legal age of marriage across the country from 14 for females and 18 for males, to 18 and 21 respectively. The recently proposed amendment to this act seeks to increase the female legal age of marriage in India from 18 to 21 and aims to empower women through greater educational opportunities. However, this bill fails to address the number of child marriages still occurring country-wide and the negative effect they may have on a girl's completion of primary and secondary education, particularly in rural areas. Therefore, the analysis provided in this paper may have implications for better-informed policy decisions.

3.2 Data Source

This paper uses data from the 2011-2012 India Human Development Survey (IHDS-II), which is a nationally representative, multi-topic study that provides information on health, education, income, employment, gender, and social inequality. The primary survey contains data from 42,152 households located in 1,503 villages and 971 urban neighbourhoods across India. This paper specifically utilises the “eligible woman’s” dataset, where an eligible woman is defined as an ever-married woman aged 15-49. The sample is restricted to 23,283 ever-married women between the ages of 25 and 44, to allow enough time for women to complete their education

and minimise the censorship of women who married later in life, whilst retaining the largest possible number of observations.

The IHDS-II data are ideal for this analysis, as detailed demographic, economic, and anthropometric data were collected at the individual, household, and village levels. Interviews were conducted across 33 of India’s 36 states and union territories, where all eligible women were prompted to complete questionnaires regarding their educational, marital, and reproductive history. This includes data that are vital to the present study, including completed years of schooling, age at first marriage, and menarche timing. The comprehensive nature and breadth of the survey also allow adequate heterogeneity analysis and exploration into secondary outcomes.

3.3 Data Analysis

The specified sample is highly representative, with data reflecting the national patterns of low female marriage age, education levels, and literacy rates. Though the median age at first marriage is 18, 46.3% of women were married before this age. The median completed schooling is 5 years, and 36.7% of individuals are considered illiterate. See Appendix 1 for detailed summary statistics.

Table 1 reports various measures of educational attainment by marriage timing. The data show considerable differences between the educational attainment of those married below the age of 18 and those married as adults. Those who have married as children have less than half the average years of education of those married in adulthood, as well as much lower literacy rates. Therefore, these preliminary findings support the hypothesis that a delay in marriage would lead to an increase in both completed years of schooling and literacy.

Table 1: Educational Attainment by Age at Marriage

	Full Sample	Those Married After 18	Those Married Before 18
Average Years of Education	5.45	7.41	3.17
No Education	36.01%	21.43%	52.94%
Complete Primary	39.15%	56.70%	18.77%
Complete Secondary	24.17%	38.31%	7.75%
Complete Post-secondary	13.41%	22.76%	2.55%
Any Higher Education	7.35%	12.93%	0.87%
Literacy	63.32%	77.93%	46.35%

3.4 Methodology

This study uses two empirical strategies to estimate the effect of marriage age on female educational attainment, the first being of ordinary least squares (OLS) specification. Baseline OLS estimates are likely to be confounded by the presence of endogeneity in the relationship, as discussed in the literature review. To isolate the causal influence of marriage age, this paper employs a two-stage IV estimation strategy of the following form:

$$A_i = \beta_o + \beta_1 Z_i + \beta_2 X_i + \varepsilon_i \quad (1)$$

$$Y_i = \beta_o + \beta_1 A_i + \beta_2 X_i + \varepsilon_i \quad (2)$$

where, Y_i is the outcome of interest, A_i is individual i 's age at marriage, Z_i is individual i 's age at menarche, and X_i is a set of controls.

The first dependent variable of interest is years of completed education, which takes values from 0 to 16 and is treated as continuous for model simplification. The second dependent variable is a binary measure of literacy, taking a value of 1 where a woman is considered literate and 0 where she is not. The main independent variable is age at first marriage, also treated as a continuous variable to ease interpretation. The instrument, age at menarche, is treated as continuous, mirroring Field and Ambrus' (2008) study. The motivation behind the instrument choice is discussed below.

Both OLS and IV regression equations will include the following set of controls: age, state, religion, caste, residence type (rurality/urbanity), various family background characteristics, and adult height as a proxy for nutrition. Family background characteristics include both parents' educational attainment and literacy, number of sisters, and number of siblings.

3.5 Instrumental Relevance

The instrument choice is motivated by sociological and anthropological research, which finds that parents in many developing nations become anxious to marry off their daughters after the onset of puberty, in fear of forbidden romantic relationships, pre-marital pregnancies, and social stigmas surrounding unmarried postpubescent girls (Caldwell *et al.*, 1983; Srinivas, 1984; Raj *et al.*, 2019). The sample mostly reflects these patterns, with only 8.93% of respondents reporting pre-pubescent marriages. As shown below in Figure 1, the mean age at first marriage increases steadily with the onset of menarche between the ages of 12 and 16.

Figures 2 and 3 show the distributions of marriage age and menarche, illustrating a significant symmetric shift in the marriage timing with each menarche age group that resembles observations by Field and Ambrus (2008). By exploiting variation in menarche timing, this analysis aims to obtain exogenous variation in women's age at marriage. As a significant proportion of the variation in the timing of menarche is determined by random genetic variation, it is likely to serve as a good instrument (Campbell and Udry, 1995).

Figure 1: Onset of Menarche and Corresponding Mean Age at First Marriage

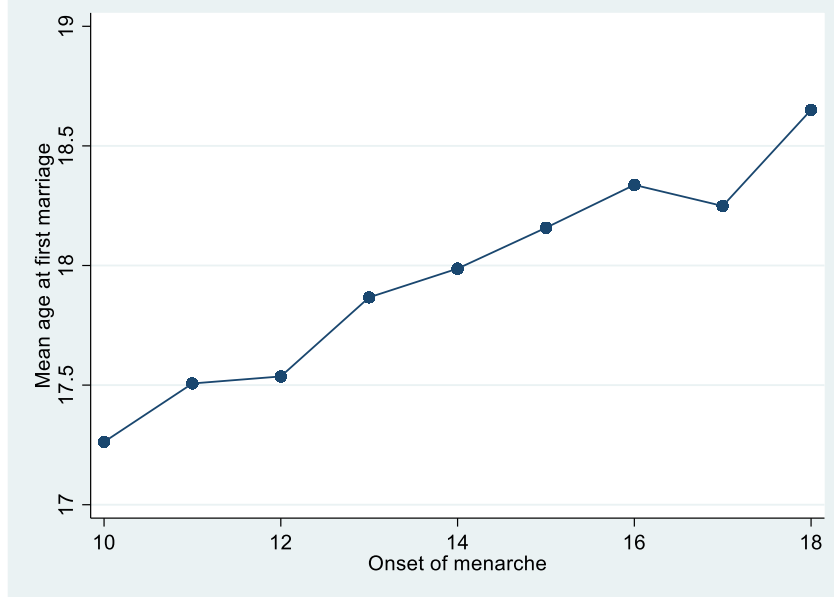


Figure 2: Kernel Density Estimates of Age of Menarche and Age of Marriage

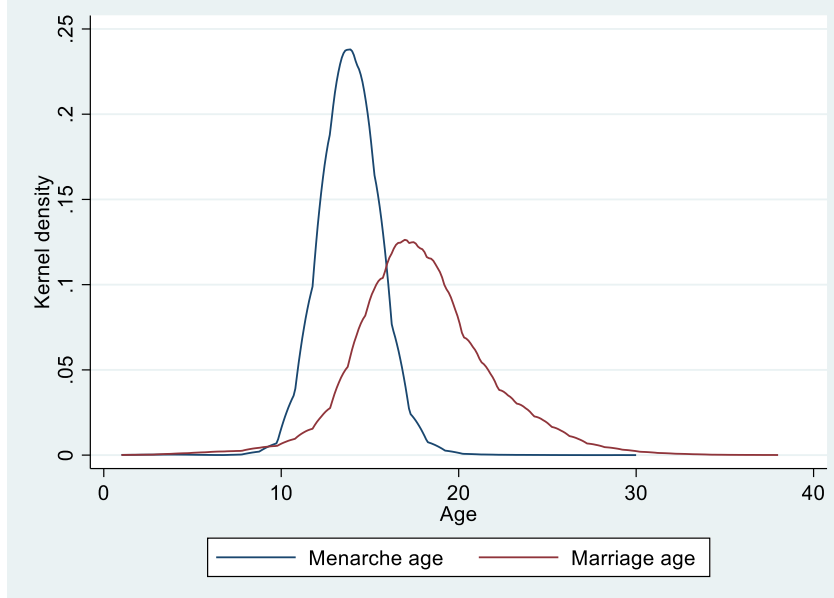


Figure 3: Kernel Density Estimates of Age of Marriage by Age of Menarche

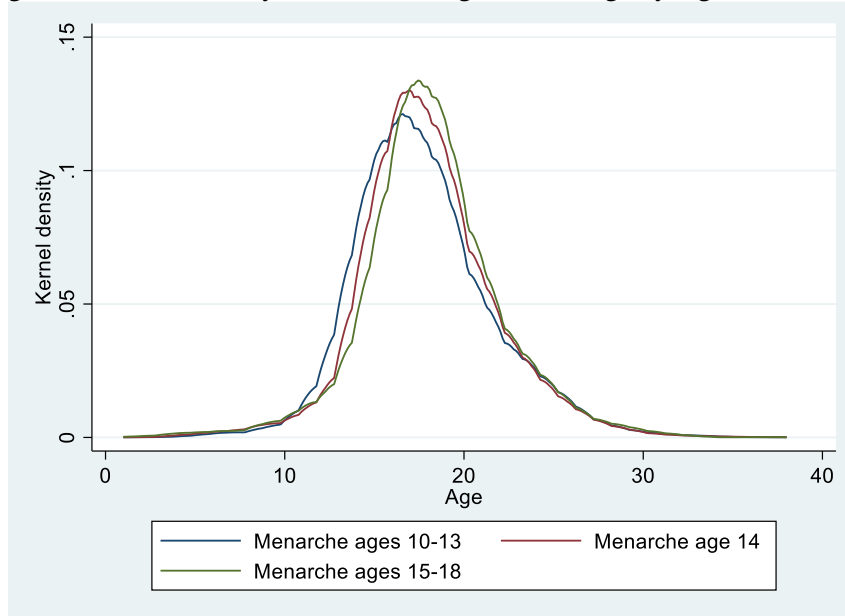


Table 2: OLS Results for Age of Menarche on Age at Marriage

VARIABLES	Age at Marriage			
	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Menarche Age	0.157*** (0.024)	0.143*** (0.024)	0.143*** (0.024)	0.305*** (0.019)
Height	-	0.058*** (0.005)	0.058*** (0.005)	0.009** (0.004)
Age	-	-	-0.054*** (0.005)	-0.063*** (0.004)
All Controls	No	No	No	Yes
Constant	15.786*** (0.328)	7.136*** (0.804)	8.971*** (0.819)	17.316*** (0.735)
Observations	23,283	23,283	23,283	23,283
R ²	0.004	0.013	0.020	0.288
F-statistic	43.65	90.14	104.39	101.20

Standard errors clustered at PSU-level reported in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 2 presents results from the first-stage regression (see Appendix 2 for full table), which reveal a strong correlation between age of menarche and marriage age. For the specification with the full set of controls, a one-year increase in age of menarche postpones marriage by 0.31 years. These estimates are significant at the 1% level, with a low standard error of 0.02 and an F-statistic of 101. Therefore, the instrument satisfies the instrumental relevance condition. Again, results are in line with previous findings (ibid.).

3.6 Instrumental Exogeneity

To be implemented, age at menarche must also satisfy the instrumental exogeneity condition. Although research surrounding biological impacts on menarche timing suggests that random genetic variation is the strongest predictor of pubescent development (Campbell and Udry, 1995), experimental literature notes that there may be a role for external influences. Of all the possible influences on menarche timing, two may confound this analysis: geography and climate (Nazian and Piacsek, 1976; Lehrer, 1986), and acute malnutrition (Stathopulu *et al.*, 2003). As geography and climate differences are not stark within states, 33 state dummies are included in all equations to limit the effect of inter-state variation. As argued by Field and Ambrus (2008) and Chari *et al.* (2017), adult height acts as a sufficient proxy for childhood nutrition and is therefore included in the vector of controls. This is further motivated in Appendix 3. Sekhri and Debnath (2014) also note the effect of extreme weather shocks on agriculture, which may affect the nutrition of many Indians, particularly in rural areas. To account for this possibility, all equations include age controls.

4 Results

4.1 Educational Attainment

This study observes the impact of marriage timing on two separate measures of educational attainment, highest completed years of schooling and literacy. OLS and IV estimates are reported in Table 3 (see Appendix 4 for full table).

Table 3: OLS and IV Results for Marriage Age on Completed Years of Schooling and Literacy

VARIABLES	Completed Years of Schooling		Literacy	
	(1) OLS	(2) IV	(3) OLS	(4) IV
Marriage Age	0.336*** (0.009)	0.321*** (0.059)	0.020*** (0.001)	0.019*** (0.007)
Controls	Yes	Yes	Yes	Yes
Constant	-3.049*** (0.719)	-2.722* (1.420)	0.242*** (0.084)	0.252 (0.170)
Observations	23,283	23,283	23,283	23,283
R ²	0.547	0.547	0.337	0.337
F-statistic	531.75	501.43	201.24	191.20
Underidentification test	-	229.113***	-	229.113***
Weak identification test	-	385.643	-	385.643

Standard errors clustered at PSU-level reported in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

OLS results indicate that postponing marriage by one-year increases completed years of schooling by an average of 0.34 years. Correspondingly, a one-year delay is associated with an increase in adult literacy by 2 percentage points. For both equations, these results are significant at the 1% level. While these estimates are prone to bias, they serve as useful benchmarks for comparison against IV results, thus allowing differentiation between correlation and causality.

The IV estimates are also significant at the 1% level, with results indicating that a one-year delay in marriage increases completed years of schooling by an average of 0.32 years. A one-year postponement of marriage is also associated with a 1.9 percentage-point increase in adult literacy. These estimates also withstand multiple comparison correction methods, as Bonferroni adjusted p-values yield significant results at the 1% and 10% levels for completed years of schooling and literacy, respectively. The high F-statistics show that the independent variables are significant in explaining the variation in years of schooling and literacy, and a

moderately high R^2 for both IV regressions shows that the models are a relatively strong fit for the data. The instrument, age at menarche, can be considered relevant given the statistically significant results of the underidentification test. It may also be said to have strong explanatory power over the endogenous variable, as the Cragg-Donald Wald F-statistic is 385.64, higher than all Stock-Yogo weak identification critical values (Stock and Yogo, 2005). Though these estimates are slightly lower than those of OLS specification, indicating some level of upward bias in the baseline OLS results, the estimation strategies yield similar results.

4.2 Heterogeneity Analysis

To observe how this relationship varies across residence types, this study conducts heterogeneity analysis between urban and rural subgroups. IV estimates for each subgroup are reported in Tables 4 and 5 (see Appendix 5 for full tables).

Table 4: IV Results for Marriage Age on Completed Years of Schooling by Residence Type

VARIABLES	Completed Years of Schooling			
	(1) Metropolitan Urban	(2) Other Urban	(3) More Developed Village	(4) Less Developed Village
Marriage Age	-0.091 (0.212)	0.419*** (0.123)	0.426*** (0.081)	0.187 (0.114)
Controls (excluding Residence Type)	Yes	Yes	Yes	Yes
Constant	4.732 (4.869)	-8.557*** (2.618)	-3.962* (2.278)	-0.177 (2.453)
Observations	1,715	6,339	6,959	8,270
R^2	0.389	0.542	0.501	0.442
F-statistic	81.27	160.22	386.54	117.37
Underidentification test	24.458***	48.582***	109.854***	64.390***
Weak identification test	38.741	77.017	188.389	114.803

Standard errors clustered at PSU-level reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5: IV Results for Marriage Age on Literacy by Residence Type

VARIABLES	Literacy			
	(1) Metropolitan Urban	(2) Other Urban	(3) More Developed Village	(4) Less Developed Village
Marriage Age	0.009 (0.017)	0.011 (0.012)	0.038*** (0.010)	-0.001 (0.015)
Controls (excluding Residence Type)	Yes	Yes	Yes	Yes
Constant	0.319 (0.373)	0.105 (0.267)	-0.064 (0.300)	0.588* (0.324)
Observations	1,715	6,339	6,959	8,270
R ²	0.212	0.284	0.296	0.299
F-statistic	71.13	40.07	198.38	1038.94
Underidentification test	24.458***	48.582***	109.854***	64.390***
Weak identification test	38.741	77.017	188.389	114.803

Standard errors clustered at PSU-level reported in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Estimates for the “more developed village” subsample were significant at the 1% level, indicating that a one-year delay in marriage in such areas increases completed years of schooling by an average of 0.43 years and literacy by 3.8 percentage points. The estimates for schooling completion for the “other urban” subsample share the same level of significance, with estimates suggesting that postponing marriage by one-year increases completed years of schooling in these areas by an average of 0.42 years. However, results for literacy are not significant, indicating that marriage timing does not influence literacy in non-metropolitan urban areas of India. Estimates for the “metropolitan urban” and “less developed village” subsamples were also insignificant, suggesting that marriage timing has no effect on either measure of educational attainment in areas of high rurality or urbanity.

Overall, the results indicate that the effect of early marriage is highest amongst non-metropolitan urban regions and more developed villages.

4.3 Secondary Outcomes

As a delay in marriage may have secondary effects, this paper also analyses data on labour force participation, reproductive and healthcare choices, as well as other intra-household

dynamics. However, as noted by Field and Ambrus (2008), the effect of marriage timing on these outcomes may operate through various channels. To empirically disentangle the effects of education from other possible determinants, two equations are estimated for each outcome. Both equations are of IV specification; one which controls for completed years of schooling and one which does not. Coefficients are calculated from the estimates presented in Appendix 6.

4.3.1 Labour Market Outcomes and Opinions

Three separate outcomes are analysed to observe the effect that marriage timing has on labour market outcomes for women, including whether the respondent is in paid work, whether they are willing to work, and whether they have permission to do so.

Results show that neither a delay in women's age at marriage nor an increase in their educational attainment have a significant causal effect on their labour force participation. Despite this, the results for household opinions about women working are significant. A one-year delay in marriage is associated with a 3.5 percentage-point and 2.2 percentage-point increase in willingness to work and permission to work, respectively. However, this effect does not seem to operate through the education channel, as estimates suggest that a one-year increase in completed years of education decreases both outcomes by 0.1 percentage points.

4.3.2 Reproductive and Healthcare Practices

To observe the effect that marriage timing has on reproductive and healthcare choices, three outcomes are analysed; number of children, whether a woman received an antenatal check-up during their last pregnancy, and the number of prenatal visits they had during that pregnancy.

Results show that a delay in women's age at marriage has a causal effect on the number of children they have, with estimates significant at the 1% level. A one-year postponement in marriage is associated with an 11.5 percentage-point decrease in number of children a woman has. However, the results suggest that this effect is only partially mediated by education, as only a 1.3 percentage-point decrease in number of children can be attributed to women's consequent increase in schooling. The results also reveal that marriage timing has no effect on prenatal care during pregnancy on either the extensive or intensive margin as estimates are insignificant, suggesting that healthcare practices do not improve with later marriage.

4.3.3 Bargaining Power and Mobility Restrictions

Two separate outcomes are analysed to gauge the effect marriage timing has on intra-household dynamics: women's bargaining power and mobility restrictions. Both outcomes are measured as discrete indexes. The bargaining power index is constructed with a range of indicators, including whether a woman has a say in purchasing an expensive item, whether to buy land/property, spending on social function, what to do if they or a child falls sick, how many children to have, whom children should marry, and what to cook on daily basis. The mobility restrictions index is formed similarly and includes indicators about whether women ask permission to visit a health centre, relative/friend's home, nearby shop, or go a short distance by public transport.

Results show that a delay in women's age at marriage has a causal effect on their bargaining power in the household, with estimates significant at the 1% level. Interestingly, a one-year postponement of marriage is associated with a 15.7 percentage-point decrease in bargaining power. However, this effect is increased when controlling for education, suggesting that the part of this effect that is mediated by education increases participation in household decisions by 1.7 percentage points. The results also reveal that the effect of a one-year delay in marriage decreases women's mobility restrictions by 10.8 percentage points. However, this negative effect on household restrictions does not seem to operate through the education channel, as estimates suggest that a one-year increase in completed years of education increases these restrictions by 1.1 percentage points. These results are significant at the 5% level.

5 Evaluation

5.1 Discussion

The results presented in this paper are consistent with the findings of existing research, reaffirming that child marriage has a negative effect on educational attainment. However, contrary to the literature, this study does not observe large biases in OLS estimates. As the instrument is relevant and has strong explanatory power, the similarity between results is likely due to the heterogeneity in the impact of the instrument. Given that the IV strategy implemented estimates the local average treatment effect, the positive relationship between marriage age and years of schooling may be particularly strong for the subgroup of individuals whose marriage age was affected by the timing of menarche. However, restricting the sample to those less educated does not affect the coefficients. Thus, this analysis cannot confirm which group of women was most affected by the treatment.

Some results from the analysis of secondary outcomes are also in line with previous literature. For example, the finding that marriage timing has no effect on whether a woman is currently in work corroborates the results of Dhamija and Roychowdhury's (2020) paper. However, unlike Field and Ambrus (2008), this study finds that postponing marriage has no effect on prenatal healthcare decisions, as well as contrasting effects on women's mobility restrictions and bargaining power. These results may be explained by the possibility that older brides may face greater backlash from their partners and in-laws, as argued by Dhamija and Roychowdhury (2020).

First-stage regression estimates corroborate the validity of the IV strategy by confirming that menarche is a significant predictor of marriage age. Furthermore, the study may be considered more robust than some previous inter-country studies, as by limiting itself to one country and attempting to control for regional variation in culture, it is able to avoid some issues of unobserved heterogeneity. However, the main contributions of this paper are its comparisons between urban and rural residence types and investigation into less heavily researched secondary outcomes in the Indian context.

5.2 Limitations

Despite attempts to eliminate confounding factors, there remain some limitations to this study. Firstly, the use of retrospective data increases the likelihood of measurement error, due to recall

bias. However, as the onset of menarche, marriage, and leaving school are considered socially important events, the risk of misreporting is low, as argued by Field and Ambrus (2008). Secondly, there may be estimation issues due to selective mortality. To reduce this bias, the sample has been restricted to women under the age of 44. A further limitation of the data is that there is no information on mothers' menarche or marriage timing. As there also exists a genetic component of menarche, there is a possibility that women with later onset may benefit from having mothers who experienced the same. If this led to higher schooling attainment for the previous generation, investment in the future generation may consequently be higher. Finally, India may not be the best setting for such a study, due to the large variation in practices within the country. Further studies may wish to narrow their analysis to a more specific area, where cultural, religious, and societal norms are more homogenous.

5.3 Extensions

There is much room for further research on this topic. Given that over 36% of the sample have received no formal education, a large share of the observations is outside the sphere of influence. Extensions to this paper may therefore conduct a more focused analysis like that of Field and Ambrus' (2008) study, by estimating the magnitude of these effects on the sample of girls for whom the marriage constraint is potentially binding. Thus, comparisons can be made against the intend-to-treat estimates presented in this paper. A similar methodology may also be applied when researching secondary outcomes, to measure the magnitudes of the effects of delaying marriage mediated by education with greater accuracy.

To observe the effect of a universal constraint on women's age of marriage, further studies may wish to conduct a general equilibrium analysis. This would better inform policymakers of the effect of fully enforced marriage laws throughout the country. Furthermore, a study that also implements the first wave of IHDS data, which was collected between 2004 and 2005, may allow greater evaluation of the 2006 Prohibition of Child Marriage Act. Again, this may better inform policy through a comparison of the effect of enforcement against imposing a higher minimum legal age of marriage.

6 Conclusion

This paper provides empirical evidence that early marriages in India result in reduced educational attainment for women, corroborating evidence from other developing countries. First-stage IV estimates indicate that for each additional year that menarche is delayed, marriage is postponed by 0.31 years. Thus, this study also confirms the validity of this estimation strategy in identifying the relationship between marriage age and educational attainment, as well as other outcomes. Results show that for each year that marriage is delayed, completed years of schooling and literacy increase by 0.32 years and 1.9 percentage points respectively. The estimates provided by this study suggest that if the government were to perfectly enforce the current marriage laws, the average increase in female schooling across the country would be approximately 0.44 years. However, this estimate does not consider the theoretics of local marriage markets and is therefore likely to be an upper-bound estimate.

Overall, this paper highlights the need for more stringent enforcement of current marriage laws, particularly in non-metropolitan urban areas and less developed villages, to ensure that all girls have equal access to education. It is worth noting, however, that policy alone will not eliminate this practice, as a greater supply of schooling, as well as community-wide efforts to combat social norms and stereotypes, are necessary to empower women and encourage girls to stay in education.

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