COST-BENEFIT ANALYSIS OF STRATEGIES TO REDUCE CHILD MARRIAGE IN BANGLADESH

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Benefits and Costs of Reducing the Prevalence of Child Marriage in Bangladesh

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Abstract

In much of the developing world, early female marriage—defined as marriage before the age of 18—remains widespread despite age of consent laws banning the practice, government and NGO efforts to curtail it, increasing education levels, and economic growth. Early marriage is correlated with detrimental long-term outcomes for girls through several channels: education, health risks and health-seeking behaviors, lower intrahousehold decision-making power, and intergenerational effects, among others. Bangladesh suffers from the second highest rate of child marriage in the world, which has remained very high despite large-scale efforts to combat the problem. We perform comprehensive comparative cost-benefit analyses of six interventions from South Asia, Latin America, and Sub Saharan Africa which have demonstrated significant impacts on child marriage. We find that a program which provides girls with financial incentives conditional on marriage status is both the most cost-effective way to avert child marriages and has the highest benefit-cost ratio.

Introduction

Background

Global Patterns of Early Marriage

In much of the developing world, early female marriage—defined as marriage before the age of 18—remains widespread despite age of consent laws banning the practice, government and NGO efforts to curtail it, increasing education levels, and economic growth (National Research Council and Institute of Medicine 2005). Of women aged 20-24, 58.6% was married before the age of 18 (BDHS 2014). Child marriage is a persistent problem; UNFPA estimates that between 2011 and 2020, over 140 million girls will become child brides (2012). Furthermore, the poor are most vulnerable to child marriage—females in the poorest quintile worldwide are two and a half times more likely to marry under age 18 than those in the wealthiest quintile (UNFPA 2012).

Child marriage rates vary greatly regionally and from country to country. Rates are highest in West Africa, followed by South Asia, North Africa/Middle East and Latin America (Clifton & Frost 2011). Globally, of the girls affected by child marriage, approximately half live in South Asia (Malhotra et al. 2011). While improved socioeconomic conditions in some regions have led to a decline in child marriage, the change has been very slow.

Child marriage manifests itself differently across regions and cultural contexts and different factors influence marriage age decisions. For example, in different contexts, parents have varying degrees of control over their daughters' matrimonial decisions or the cost of dowry, which may encourage families to marry daughters earlier or later. In addition, an emphasis on virginity at marriage may lead to girls marrying sooner, or a lack of labor force opportunities may make marriage look like the only viable option. Despite these differences, child marriage is a persistent problem in many parts of the world, which has lifelong consequences for girls and their families.

Consequences of Early Marriage

The negative correlates of child marriage are substantial for girls and their families. Early marriage has the potential to have detrimental long-term effects for girls through several channels: education, health risks and health-seeking behaviors, lower intra-household decision-making power, and intergenerational effects, among others.

Globally, we observe lower levels of education among women who married in childhood. The relationship between early marriage in education likely works in both directions; girls may be pressured to drop out of school after marriage, and lower levels of education may make early

marriage a more attractive option for girls with fewer labor market opportunities. Lower levels of education can lead to a multitude of long- term direct and indirect effects for girls. Lower education implies lower lifetime earnings once they enter the workforce, as well as higher fertility and lower investment in children. While most of the evidence linking education and early marriage is corollary, some causal evidence indicates that increasing education for girls can reduce child marriage and conversely that postponing marriage increases schooling. Field and Ambrus' work (2008) in Bangladesh demonstrates a causal link between marriage and educational attainment. They find that postponing marriage by one year between the ages of 11 and 16 increases schooling by 0.3 years and health care utilization by 9.5%. Additionally, in Indonesia, causal evidence shows that higher levels of education for girls increased age at first marriage, lowered fertility rates, and reduced child mortality (Breirova and Duflo 2004).

Early marriage may also have detrimental health effects for women. Substantial literature shows a correlation both between early marriage and women's health, and between early marriage and health seeking behavior. In general, women who marry early begin childbearing at a young age (Jensen and Thornton 2003). Girls who marry as adolescents face greater health risks associated with lower age of first birth, higher fertility rates, and shorter birth spacing related to lower contraceptive use (UNICEF 2014). Childbearing during adolescence, when physiology is underdeveloped, is widely believed to result in higher levels of maternal mortality and morbidity, and complications during pregnancy and delivery are a leading cause of death among girls aged 15 to 19. The rate of maternal mortality in this group is double the rate for women in their 20s. Young mothers also have higher maternal morbidity rates, including severe complications such as obstructed labor or obstetric fistula (UNFPA and EngenderHealth 2003; Jarrett 1994). Beyond the negative health consequences, women who marry early are also less likely to actively seek healthcare and have lower levels of health information (UNICEF 2014).

Early marriage can put girls at a disadvantage and is associated with lower household decision-making power, lower status for brides within their in-law's families, and greater rates of domestic violence. Mean spouse age difference is decreasing with women's age at first marriage throughout the world. Research in sub-Saharan Africa found that the husbands of girls aged 15 to 19 years are on average 10 years older (UNICEF 2014). A similar pattern is found in Southern Asia (UNFPA 2004). Spousal age gaps are associated with lack of agency in marriage for the adolescent girl, which can contribute to poor health outcomes. Lack of decision-making power may translate into lower reproductive control and a limited capacity to negotiate sexual relations, contraception, and

childbearing. Qualitative research also suggests that most young married girls face pressure to get pregnant early in marriage and lack control over the decision to avoid pregnancy (Bledsoe and Cohen 1993; Mensch, Bruce, and Greene 1998; Bruce and Clark 2004). There is some qualitative data suggesting that isolation, restricted mobility, and lack of control over household resources are more common among women who marry young (Mensch et al. 1998).

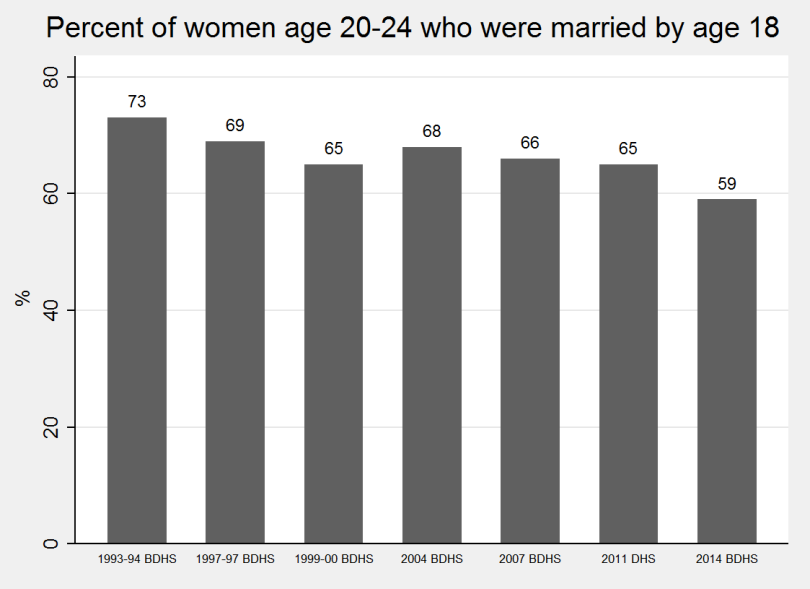
Finally, early marriage may affect not only girls who marry as adolescents, but extends to the next generation as well. In Bangladesh, the child mortality rate of children born to mothers under 20 is 33% higher than for children born to mothers aged 20-29 (BDHS 2014).

Child Marriage in Bangladesh

Bangladesh suffers from a particularly high rate of child marriage—the second highest in the world, which has remained very high despite large-scale efforts to combat the problem (UNICEF 2014). The 2014 Bangladesh Demographic and Health Survey (BDHS) shows 59% of 20-24 year olds in Bangladesh were married before 18, the legal age of marriage. The number grows to 71%, when considering women from 20-49 years of age. Despite the fact that the legal age of marriage is 18, child marriage rates in Bangladesh have changed only slowly since 1993, as evident in Figure 1, and stood at 59% in 2014 (BDHS). Bangladesh is also home to one of the largest populations of girls at risk of child marriage, with over 15 million girls aged 10-19 (Malhotra et al. 2011).

The prevalence of child marriage in Bangladesh has significant consequences for girls. Girls who marry as adolescents are more likely to begin childbearing as adolescents (31 % of all 15-19 year olds in Bangladesh have begun childbearing in 2014 compared to 33% in 2011), are less likely to use contraception (51% of married 15-19 year olds report using contraception), and are likely to give birth at home (64 % of mothers under 20 give birth at home) (BDHS 2014). While childbearing between the ages of 15 and 19 decreased overall between 2011 and 2014, it remained almost unchanged in rural areas (BDHS 2014). Young married women aged 15 to 19 are less likely than married women aged 20 to 24 to use modern contraceptives (Population Reference Bureau 2006). In Bangladesh, under-5 mortality (CMR) is 48 per 1,000 for children of mothers under 20 compared to 42 for children born to mothers aged 20-29 (BDHS 2014). Women's access to health information is also poor: 20% of adolescent mothers have little knowledge of life-threatening conditions that can occur during pregnancy, and the majority (married and unmarried) have no information on sexuality, contraception, sexually transmitted infections or HIV/AIDS (Haider, et al. 1997; Nahar, et al. 1999; Barkat, et al. 2000; Bruce and Clark 2004).

Figure 1: Child Marriage Trends in Bangladesh



Policy Approaches to Avert Child Marriages

Child marriage is a persistent problem with wide-reaching, lifelong consequences for girls worldwide. As a result, in Bangladesh and around the world, many governments, IOs, and NGOs have pursued interventions to prevent child marriages. These interventions take a wide range of approaches which include minimum age requirements for marriage, dowry prohibitions, encouraging education by improving the quality and quantity of schooling for girls, empowerment education for girls, various conditional and unconditional cash transfer programs, and improving labor market opportunities.

Minimum age requirements are one of the most widely adopted approaches. Many countries, including Bangladesh, have laws which require a minimum age for marriage and do not allow for exceptions such as parental consent. These laws intend to increase marriage age by creating hard legal requirements and imposing sanctions on parents who marry their daughters before the age of consent. However, enforcement is often lax, and descriptive evidence suggests they have little effect on age of marriage. Evidence from Bangladesh, where the minimum legal age of marriage is 18 for girls, shows that the age laws had almost no effect on the timing of marriage for rural households outside of encouraging misreporting on documents (Cammack et al. 1996).

Similarly, dowry prohibitions are a common strategy to combat child marriage in South Asia. India originally banned dowries in 1961, and Bangladesh has a series of laws banning the practice back to 1980. Despite the bans, the dowry system remains an important part of the local marriage markets in both countries. In Bangladesh, approximately two-thirds of brides under age 30 report some dowry payment to their husband's family at the time of marriage (Field and Ambrus 2008). Since

banning dowries in India, average dowry prices have risen in real terms and the practice has expanded geographically and socially where dowry was not formerly customary (Anderson 2003).

Legal and policy frameworks, such as minimum marriage age regulations and dowry prohibitions, seek to influence individual behavior and move cultural norms. However, these laws are difficult to enforce and have been largely ineffective at reducing the practices they seek to ban.

A third approach involves encouraging education by increasing the quality or quantity of schooling for girls. Since years of schooling have a direct impact on age of marriage, these interventions aim to delay marriage for girls by providing them with improved educational opportunities. These may include efforts like establishing community schools, training teachers, providing study materials, and the construction or renovation of existing schools. In places with a low supply of schools, reducing distances to school has been shown to significantly increase enrollment for girls. For example, the Partnership for Advancing Community-based Education in Afghanistan (PACE-A) worked to expand education opportunities to girls in areas of the country that lack access to formal government schools. PACE-A provided teacher training and classroom materials to establish schools in community provided spaces. A random evaluation of the program found significant increases in enrollment rates overall and for girls in particular (Burde et al. 2013). The intervention increased girls schooling, but as is the case with many education-focused evaluations, the researchers did not collect data on age of marriage.

Female empowerment programs seek to delay marriage by helping girls develop skills, which allow them to better negotiate their own choices and encourage independence. These programs often include life skills and vocational training and are delivered at adolescent development clubs by older girls or through peer sessions. By creating safe spaces and building support networks, empowerment programs like this may also help girls to see viable alternatives to marriage and increase professional aspirations while helping create safe spaces and building support networks for adolescent girls. If girls can be given both life skills and vocational training, they may have fewer incentives to marry early and feel empowered to enter the labor market.

Conditional transfers in various forms are also a common approach to averting child marriage whether through encouraging schooling or directly incentivizing girls to delay marriage. To encourage education, cash transfers may be conditional on school enrollment, attendance, or grades in an effort to reduce costs for girls and their families and encourage additional years of schooling. Secondary school stipends, such as the Female Secondary School Stipend in Bangladesh described

further in detail below, are one form of a conditional cash transfer which aim to increase schooling by providing funds to girls conditional on their enrollment. In Colombia, vouchers to attend private school may increase access to school and quality of instruction (Angrist et al. 2006). Noncash transfers conditional on school enrollment have also shown promise in increasing schooling and reducing age of first marriage or cohabitation. In Kenya, providing free uniforms to school age girls led to increased school attendance and test scores (Duflo et al. 2006).

Unconditional cash transfers to high-risk girls also may be effective in increasing age at first marriage or cohabitation. Girls and their families may face significant financial tradeoffs when deciding when to marry, and unconditional transfers may help them delay marriage by offsetting the cost of waiting. In Malawi, unconditional transfers delayed marriage and pregnancy and increased years of schooling (Baird et al. 2011).

Finally, transfers conditional on marriage have been used to directly incentivize girls to delay marriage. These programs provide financial incentives to girls and their families conditional on marital status. Generally, payments are either conditional on girls being unmarried when turning 18 or to girls that are unmarried and under 18. For example, In Haryana India, the Apni Beti Apna Dhan program provides girls with a payment at age 18 if they are still unmarried. In Bangladesh, unmarried girls received free cooking oil as long as they remained unmarried, an intervention described in detail below. Despite bans of the practice, dowries are commonplace in Bangladesh with the amount of dowry paid by the bride's parents increasing with the age of the girl (Population Council 2005). This can incentivize parents to marry their daughters earlier in order to avoid paying a higher dowry once their daughter is older. Transfers conditional on staying unmarried may help compensate for additional dowry payments in the future.

While not a direct intervention, improving labor market opportunities and access to recruiting services have been shown to delay marriage, reduce fertility, and increase education. In Bangladesh, the arrival of garment factories in an area led to an increase of marriage age and years of education for girls within commuting distance (Heath and Mobarak 2015). In India, greater access to business process outsourcing recruiters increased women's rate of employment outside of the home and increased age of marriage (Jensen 2012).

Cost-Benefit Analyses

We conducted a cost-benefit analysis comparing various approaches to reducing the incidence of early marriage. For the cost-benefit analyses, we consider six programs from South Asia, Sub Saharan African, and Bangladesh which demonstrate impacts on child marriage rates or girls' age of marriage.

We include only interventions for which there are medium to high quality evaluations which tracked child marriage or marriage age as an outcome. Studies were rated low quality and excluded if: there were too few clusters to estimate cluster errors, there was insufficient information on the methodology to judge its quality and/or there was no information on the statistical significance of the results, or there was potential for selection bias between those who participated in the program and those that did not without credible methodology of addressing the selection bias. For example, Krishnan et al. (2014) evaluate the effect of a state wide program in Haryana by comparing marriage age of girls in Haryana with daughters-in-law living in Haryana but originally from other states. However, girls who marry into another state are likely to be different on many dimensions to those who marry within their state. Below is a summary table of interventions we considered for the analysis with quality rankings for each evaluation. We also excluded interventions with outcomes that were not robust to small changes in specification such as Alam et al. in Pakistan (2011).

Table 1: Summary of Evaluations of Child Marriage Prevention Programs

Intervention	Country	Paper	Methodology	Outcome	Quality
Africa					
Berhane Hewan	Ethiopia	Erulkar and Muthengi (2009)	Matched villages	age of marriage, schooling	Low
Free school uniform	Kenya	Duflo et al . (2015)	RCT	schooling, pregnancy	High
Zomba CCT	Malawi	Baird et al. (2010, 2011)	RCT	schooling, pregnancy, marriage	High
Zomba UCT	Malawi	Baird et al. (2010, 2011)	RCT	schooling, pregnancy, marriage	High
Ishraq	Eygpt	Brady et al. (2007)	Matched villages	education, marriage preferences	Low
BRAC ELA Centers	Uganda	Bandiera et al. (2012)	RCT	pregnancy, safe sex practices	High
BRAC ELA Centers	Tanzania	Buehren et al. (2015)	RCT	marriage, scholing, safe sex practices	High
South Asia					
Brac ELA Centers	Bangladesh	Shahnaz and Karim (2008)	Members vs nonmembers	education, marriage	Low
Kishori Abhijan	Bangladesh	Amin (2007)	Matching	marriage, education	Low
Maharashtra Life Skills	India	Pande et al.(2006)	Random over 2 units	marriage, education	Low
Reproductive health	Nepal	Mathur et al.(2004)	Matched villages	pregnancy, marriage	Low
DISHA	India	Kanesathasan et al.(2008)	Propensity score matching	age of marriage	Low
Apni Beti Apna Dhan	India	Krishnan et al.(2014)	Local vs out of state girls	education, marriage	Low
Apni Beti Apna Dhan	India	Sinha and Yoong (2009)	Instrument for eligibility	education	Medium
Apni Beti Apna Dhan	India	Nanda et al.(2014)	Eligible vs ineligible girls	education	Low
Garment factor placement	Bangladesh	Heath and Mobarak (2015)	Difference in Difference	education, marriage	High
FSSP	Bangladesh	Heath and Mobarak (2016)	Difference in Difference	education, marriage	Medium
FSP	Pakistan	Alam et al. (2011)	RD, Diference in Difference	education, marriage	Medium
BPO job opportunities	India	Jensen (2012)	RCT	education, marriage	High
Free school and FSSP	Bangladesh	Hong and Sarr (2012)	Difference in Difference	education, marriage	Medium
Female school stipend	Bangladesh	Hahn et al.(2015)	Difference in Difference	education, marriage	Medium
Latin America					
Vouchers to private schools	Colombia	Angrist et al.(2002, 2006) Bettinger et al. (2014)	RCT	education, cohabitation	High

Although encouraging education for girls is a relatively common approach, child marriage is often a secondary outcome of interest for education interventions. Many evaluations of such programs, including the community-based schools in Afghanistan, fail to look at impacts on age of marriage or marriage rates. We may suspect that increases in years of schooling will lead to delayed marriage, but without evidence of marriage impacts we cannot confidently include them in the CBA. For this reason, we have not included education interventions for which evaluations did not track marriage as an outcome. Appendix Table A includes a list of high quality evaluations which we considered, but which did not track marriage outcomes for girls.

Increasing access to labor market opportunities has also been shown to increase age of marriage and increase education for adolescent girls in Bangladesh and India (Jensen 2012, Heath and Mobarak 2015). However, we do not include these evaluations in our analysis since they are not direct interventions but rather studies of the impacts of broader labor market trends on girls' lives.

Descriptions of Interventions Considered in the Cost-Benefit Analysis

Intervention 1: The Female School Stipend Program in Bangladesh

Bangladesh introduced the Female Secondary School Stipend Program (FSSAP), a large-scale education promotion program, in 1994 to make secondary education free for girls in rural areas. The program aimed to address the gender gap in secondary education by encouraging more girls to complete secondary education. In addition to free schooling, the FSSAP paid a small stipend to eligible girls conditional on their enrollment, a minimum 75% attendance rate in school, a minimum 45% average on annual exams, and remaining unmarried. The level of the stipend varied by grade and by year. The program covered more than two million girls each year and was the Bangladesh government's most prominent education program through the 1990s and 2000s (Hahn, et al. 2015). The program later was changed to include stipends for poor boys in addition to girls. We only consider the first iteration of the FSSAP in our analysis.

Hong and Sarr (2012), Hahn, et al. (2015), and Heath and Mobarak (2015), all evaluate the impact of the FSSAP in Bangladesh using a difference-in-difference strategy. Hahn et al and Hong and Sarr both exploit the fact that only girls in rural areas were eligible for the stipend and compare education and marriage outcomes for rural vs urban girls before and after the introduction of the FSSAP. The main difference between the two is that Hong and Sarr also examine the earlier introduction of free secondary education for girls. Both papers find large effects on education and age of marriage from the FSSAP (an increase in age of marriage of 0.6 to 2.3 years). It is worth noting

a caveat to these results, the raw age of marriage data suggests that the changing gap between rural and urban ages of marriage is driven mainly by a collapse in the age of marriage of urban girls rather than an increase in age of marriage of rural girls. Heath and Mobarak examine the impact of the FSSAP in peri-urban areas (still classed as rural) by comparing girls who reached secondary school just before the FSSAP and just after the FSSAP and find no statistical difference. They note that the gender gap on education was closing long before the introduction of the FSSAP and that there was no trend break in the steadily increasing secondary school enrollment rates in the country as a whole. A key difference with the other FSSAP papers is that the authors do not exploit geographic differences in eligibility (which could confound program impact with differential trends in rural vs urban areas), and compare girls in a much shorter age window around the introduction of the program.

Intervention 2: Vouchers for Private Education in Colombia

In 1991, the Colombian government established a voucher program for low income students to attend private schools as a way to rapidly expand secondary school access despite limited public secondary schools. The Programa de Ampliación de Cobertura de la Educación Secundaria (PACES) was one of the largest voucher programs to date, providing over 125,000 students from poor urban neighborhoods with vouchers that cover more than half of the cost of private secondary schools in Colombia. PACES vouchers covered the average tuition of low-to-middle cost private schools in Colombia's largest cities. The vouchers were available for both boys and girls and distributed by random lottery within the pool of eligible applicants. The random allocation of the vouchers has allowed for a series of evaluations to establish rigorous evidence of the impacts of the program (Angrist, et al. 2002, Angrist, et al. 2006, Bettinger, et al. 2010). The vouchers increased test scores for girls and led to a decrease in cohabitation.

Intervention 3: Free School Uniforms in Kenya

While the Kenyan government eliminated school fees in 2003, students are generally still required to purchase and wear uniforms to attend school. The Child Sponsorship Program, a project of ICS-Africa, implemented a non-cash transfer intervention in Busia Kenya which provided free school uniforms to primary school students. The uniforms were meant to decrease financial barriers to schooling and raise attendance for both boys and girls. Schools were randomly assigned to participate in the program which allowed for causal inferences from a randomized evaluation. In total, 83 schools received the stand-alone school uniform subsidy with an average of 29.3 eligible girls per school. (Duflo, et al. 2015). The program increased schooling and decreased marriage rates.

Intervention 4: Empowering Adolescent Girls in Uganda

From 2008-2010, a large cluster randomized trial evaluated BRAC's Empowerment and Livelihood for Adolescents Program (ELA) in Uganda. The program worked with BRAC's permanent centers in villages to provide life skills and vocational training for girls aged 14-20 through adolescent development clubs and sessions led by young female mentors. The clubs were open five afternoons a week after school and covered issues of sexual and reproductive health, menstruation, pregnancy, STIs and HIV/AIDS awareness, family planning and rape. Additionally, trainings provided information on conflict resolution and legal standards regarding bride-price, child marriage, and domestic violence. Vocational skills training focused on small business development, including courses on tailoring, computing, and dancing. The clubs served as a center of recreation for the girls and provided a safe space in which they could meet and privately discuss their problems. ELA centers led to decreases in underage marriage and cohabitation and significantly reduced childbearing. Additionally, girls in villages with ELA centers were more likely to practice safe sex and were less likely to have had a pregnancy (Bandiera, et al. 2015).

Intervention 5: Conditional Financial Incentives in Bangladesh

In collaboration with Save the Children (USA), a large clustered randomized trial in southern Bangladesh examined a conditional stipend programwhich encouraged parents not to marry their adolescent daughters before the legal age of consent. The program distributed cooking oil to girls aged 15 through 17 and confirmed to be unmarried. The oil was distributed every four months between April 2008 and August 2010 with monitors checking the marital status of the girls before each distribution. Overall, conditional on remaining unmarried, girls received four liters of cooking oil in each distribution which was the equivalent of roughly $16 per girl per year. The cooking oil was meant to offset the financial cost of higher dowry associated with marrying at an older age (Population Council, 2004). The oil incentives led to significantly reduced child marriage rates and increased years of schooling for girls, relative to girls in control villages. Girls who participated in the program were 21-30% less likely to marry under age 16 and 19-22% more likely to be in school (Buchmann, et al. in process).

Intervention 6: Unconditional Cash Transfers for Girls in Malawi

Between 2008 and 2009, researchers performed a randomized evaluation of an unconditional cash transfer (UCT) program for girls in Malawi. The study took place in southern Malawi's Zomba district in both the large urban center, Zomba city, and many surrounding rural and semi-rural villages. Girls and their families received monthly stipends over the course of two school years. The transfers

ranged from $4 to $10 plus the cost of school fees. Girls receiving the cash stipends were 8 percentage points less likely to be married and 7 percentage points less likely to be pregnant than girls in the comparison group. A parallel study of a cash transfer conditional on 80% school attendance found no significant effects on marriage or pregnancy outcomes, but did find improvements in school enrollment, attendance, and test scores. The UCT program may have been more effective in delaying marriage and childbearing because it allowed girls who dropped out of school to support themselves without relying on a husband (Baird, et al. 2011, 2016).

Interventions with No Estimated Impact on Child Marriage

Below we present a table of evaluations we considered but did not include in the CBA analysis because the interventions showed no statistically significant impacts on child marriage.

Table 2: Summary of Interventions with No Significant Impacts on Child Marriage

Interventions with No Significant Impacts on Child Marriage		
Intervention	Method of Estimation	Evaluation
Minimum Marriage Age Laws		
Minimum Marriage Age Laws in Indonesia	time series plot, distribution	Cammack, et al. (1996)
Dowry Prohibitions		
Bangladesh Dowry Prohibition Acts	theory paper	Huda, et al. (2006)
India Dowry Prohibition Act	theory paper	Anderson (2003)
Conditional Cash and Noncash Transfers		
Apri Beti Apna Dhan (Haryana India)	local vs out of state girls	Krishnan, et al. (2014)
Transfers conditional on education in Malawi	RCT	Baird, et al. (2011)
Empowering Adolescent Girls		
Kishoree Kontha Empowerment Program in Bangladesh	RCT	Buchmann, et al. (In process)
BRAC ELA Program in Tanzania	RCT	Buehren et al. (2015)
Kishori Abhijan in Bangladesh	matching	Amin (2011)
Youth Reproductive Health in Nepal	nonrandom matching	Mathur et al. (2004)

Methodology

Benefits of delayed marriage are calculated based on the cumulative education wage premium for girls eligible for each program. We assume girls start working at age 17.5, the median age of marriage for girls in the control group of the oil incentives evaluation (Buchmann et al *in process)*, and continue working until they are 60. We assume that wage returns to education are constant across their working life, and that the returns to years of secondary education are equal for women in and out of the workforce. We assume that extra education delays girls' entries into the workforce,

and that they begin working immediately after finishing their studies, provided they are older than the median age of marriage. To consider all interventions in the same time frame, we consider all interventions had they started in 2008.

To estimate the wage premium benefits of the program, we use the estimated wage premium from Montenegro and Patrinos (2014) to determine the estimated income for girls in each year of each program. They use a modified Mincer equation to estimate girls' expected wages in each year of their working life as a function of education and experience, which we modify to calculate a girl's age in each year:

$$income_t = \prod_{k=1}^{t}(1+\rho_k) \quad * e^{(\alpha + \beta_1(years\ of\ schooling) + \beta_2(experience_t) + \beta_3(experience_t{}^2) + \varepsilon}$$

Where α is the log of mean income 2005-2014 for women in Bangladesh with no education or experience (Montenegro and Patrinos 2014). To account for growth in wage levels over time, ρ is the GDP per capita growth in Bangladesh for years until 2014 and the mean growth rate from 2005-2014 for 2015 and after. *t* is the year of the analysis. All interventions are considered as beginning in 2008, the first year of the oil incentive program, which we use as the base year for our calculations. Girls enter the workforce in 2010, defined as the year they reach median age of marriage, adjusted for additional education induced by each intervention. Experience is calculated as the number of years since a woman entered the workforce. β_1 is the private return to an additional year of secondary schooling in Bangladesh, 8.1% in 2005 (Montenegro and Patrinos 2014), the latest year for which data are available. The terms β_2 and β_3 are estimates of the returns to experience and experience squared for women in Bangladesh.

To calculate the benefits for each year of an intervention, we first calculate estimated wages for a girl receiving the intervention and the estimated wages for a girl not receiving the program.

For girls receiving the program, income in each year is estimated as:

$$\prod_{k=1}^{t}(1+\rho_k)$$
$$* e^{(\alpha + \beta_1(median\ schooling + \lambda) + \beta_2(t - median\ marriage\ age - \lambda) + \beta_3((t - median\ marriage\ age - \lambda)^2)}$$

Where λ is the point estimate for the education benefit of a program. For girls not receiving the program, income in each year is estimated as:

$$\prod_{k=1}^{t}(1+\rho_k) \quad * e^{(\alpha+\beta_1(median\ schooling)+\beta_2(t-(median\ marriage\ age)+\beta_3((t-(median\ marriage\ age))^2)}$$

For the girls receiving the program, this takes into account the educational income premium from the additional years of schooling induced by the program as well as the loss of work experience from staying in school. As mentioned above, experience begins to accrue for all girls not in school after the median age at first marriage.

The present value of both costs and benefits of each program are then defined as follows:

$$Present\ Value\ = \sum_{t=0}^{T} \frac{(annual\ program\ costs/benefits_t)}{(1+\theta)^t}$$

Where *T* is the number of years between the beginning of the intervention and the end of a woman's working life and θ is the social discount rate. We report results using a social discount rate of 5%, and additionally provide sensitivity analyses with discount rates of 3% and 10%.

For all calculations, we first take the present value of the program cost and benefit streams in 2008 BDT as described above. We then reflate the streams to 2014 BDT using year specific inflation rates. Finally, we convert the streams from 2014 BDT to 2014 USD. For the implementation cost calculations, we first convert from local currency to BDT in the year of the intervention. We then inflate the costs to 2008 BDT using inflation rates from Bangladesh and proceed using the same order of operations as for the other streams.

Benefits Calculations

We define the benefits each year as the estimated income for a girl receiving the intervention minus the estimated income a girl in the program would have received without the education benefit of the program. This is the annual education benefit we expect girls to receive from having been induced to study longer by each intervention. As detailed above, the estimated income for a girl receiving a program is:

$$\prod_{k=1}^{t}(1+\rho_k)$$
$$* e^{(\alpha+\beta_1(median\ schooling+\lambda)+\beta_2(t-median\ marriage\ age-\lambda)+\beta_3((t-median\ marriage\ age-\lambda)^2)}$$

From this we subtract the counterfactual wages for a girl who participated in the program, but did not receive the education benefit:

$$\prod_{k=1}^{t}(1+\rho_k)$$

$$* e^{(\alpha+\beta_1(median\ schooling)+\beta_2(t-median\ marriage\ age-\lambda)+\beta_3((t-median\ marriage\ age-\lambda)^2)}$$

This gives us the benefit per eligible girl in any given year. The annual benefit is defined as the above term multiplied by the total number of girls eligible.

For the cost benefit analyses, we also consider the value of stipends or transfers as benefits, discounted to 2008 and reflated to 2014 USD as described above.

Note that wage premiums are based on wages of those in the labor force with monetized wages. The assumption behind Mincer equations and our estimates is that education increases productivity as much for women not earning a wage (including those working in the household) as it does for women working for a wage outside the household. Our results are likely to be sensitive to this assumption, but the assumption has the same impact on all programs equally. Cost-effectiveness calculations using only costs to implementers, however, do not require reliance on this assumption and simply express how many additional years of education can be gained from spending on a given program.

Estimates of Additional Years of Schooling from Delayed Marriage

For each program for which we have data on impacts on education, we calculate the educational benefits to delayed marriage using two different methods to convert impacts on age of marriage to additional years of schooling. First, we estimate overall additional years of schooling using the education coefficient from each respective analysis and multiplying it by the number of girls eligible for the program. This is the observed impact on education in the particular context of the evaluation. Second, we estimate the additional years of schooling per year of delayed marriage for the Financial Incentives to Delay Marriage in Bangladesh. We then apply this conversion factor to the other interventions to estimate the implied additional years of schooling had the program taken place in southern Bangladesh. For studies in which we have age at first marriage as an outcome, this results in a conversion factor is 0.86 additional years of schooling for every additional year unmarried. Where we only have child marriage rates, we use a conversion factor of 0.04 additional years of schooling for every percentage point reduction in child marriage. We use only the converted impact for the evaluations which did not have a statistically significant impact on education outcomes. Where possible, we present estimates of the benefit-cost ratio for programs using both methods to calculate additional years of schooling.

We take this approach for a number of reasons. First, the quality of the evaluations varies and the estimated educational returns to the program may not be equally reliable. Standardizing the assumed educational returns to delayed marriage from a recent rigorous evaluation helps normalize the quality of the estimates. Secondly, not all of the interventions took place in Bangladesh. We might expect the educational returns to delayed marriage to be quite different in Kenya and Colombia than in Bangladesh. Estimating the educational benefits using the educational returns from Bangladesh allows us to estimate the benefit-cost ratio of the other programs had they been implemented in Bangladesh.

As discussed above, years of schooling and age of marriage are causally linked in both directions; delaying marriage leads to more schooling and more schooling leads girls to delay marriage. Many of the programs we consider in the CBA are principally intended to increase girls' educational attainment. In this CBA we are primarily interested in programs that reduce child marriage and seek to quantify the benefits of that reduction in child marriage through its impact on education. By applying a conversion factor derived from a program that primarily targeted age of marriage (and likely influenced age of marriage even for out of school girls) we may be disadvantaging the oil incentive program at the expense of those programs more focused on education.

Cost Calculations

For all programs, we consider the costs to the beneficiary as well as the costs to the implementer. For the cost to the implementer, we consider actual program costs where available and estimate program costs elsewhere. Where monitoring costs for programs with conditional eligibility were not available, we consider the monitoring costs per girl per year of the oil incentive program multiplied by the number of eligible girls and years in the relevant intervention.

We also consider the opportunity cost of girls' foregone income over their entire working life from having fewer years of work experience. This cost is the difference in lifetime income for a girl due to having less experience from having been induced to stay in school. For each year, we calculate this cost by first estimating the income of a girl with median education and experience:

$$\prod_{k=1}^{t}(1+\rho_k) \quad * e^{(\alpha + \beta_1(median\ schooling) + \beta_2(t - median\ marriage\ age) + \beta_3((t - median\ marriage\ age)^2)}$$

From this we subtract the counterfactual income of a girl with median schooling and fewer years of experience equal to the education effect of the relevant intervention:

$$\prod_{k=1}^{t}(1+\rho_k)$$

$$* e^{(\alpha+\beta_1(median\ schooling)+\beta_2(t-median\ marriage\ age-\lambda)+\beta_3((t-median\ marriage\ age-\lambda)^2)}$$

This term is the same term subtracted from the wage of a girl in the treatment arm to calculate the benefits of the program and results in the foregone wages due to fewer years of workforce experience. The total costs of each program include the program specific costs to the implementer plus the income opportunity cost of education over a participant's working life. We calculate the net present value of the cost stream using the method described above.

Additional Assumptions for the Cost and Benefit Estimates for Specific Interventions

In addition to these general assumptions, intervention-specific assumptions are described in more detail below.

Intervention 1: The Female School Stipend Program in Bangladesh

Because we did not have access to administrative cost data, we estimate program costs as the costs of secondary school stipends plus the monitoring costs per girl from the oil incentive program. For the transfer cost of the stipends, we apply the transfer rate from a similar program in Pakistan, approximately 40% of the cost of the stipend (Chaudhury and Parajuli 2006). The stipend costs are estimated by using the number of total stipends per year, the amount of the average stipend per grade, and assuming equal distribution of stipends across grade years, and that the amount of the stipend remained constant for girls while they participated in the program. We use estimates of cohort size from several sources to estimate the number of girls eligible for the stipend each year (Raynor 2016, Hahn et al. 2015, Hong and Sarr 2012). We only consider girls who were eligible for a full five years of the stipend and assume equal distribution of girls per grade. This results in estimates of approximately 11,752,000 eligible girls.

Intervention 2: Vouchers for Private Education in Colombia

To estimate the cost of the voucher program, we use average annual secondary education costs to the government per female scholarship winner (Bettinger, et al. in process). The costs include the annual value of a PACES scholarship and the expenditure from scholarship costs for students who would have enrolled in private school adjusted for expenditures resulting from transfers from public to private schools and cost savings from reduced grade repetition.

Because researchers did not directly measure age at first marriage, we use the reported change in teen pregnancy as a proxy for changes in child marriage rates. Additionally, since the results come from a non-published intermediate paper, both the costs and benefit results may still change.

To establish the number of eligible girls we use the number of vouchers distributed, 90,000, divided by the take-up rate, 90%, for a full sample of 100,000 girls (Angrist et al. 2002). For each subsequent year, we use a take-up rate of 77%, the average re-enrollment rate for scholarship recipients (Angrist et al. 2002).

Since the scholarship program moved some students from public to private schools, there may have been a number of costs and benefits to the government which we do not include. For example, we do not count changes in tertiary education costs, loan subsidies, forgone tax revenue from VAT tax, changes in government revenue, nor forgone net government transfers through payroll taxes. Many of these costs are specific to the Colombian government context and these costs may not be relevant for replications of the program in Bangladesh. Additionally, we exclude those costs for better comparability to the other programs considered.

Intervention 3: Free School Uniforms in Kenya

For the Free School Uniforms in Kenya we use reported program costs including the cost of girls' school uniforms, NGO worker wages, NGO worker travel cost. These costs are all detailed on the JPAL website cost-effectiveness section.

Intervention 4: Empowering Adolescent Girls in Uganda

To estimate the costs and benefits of the BRAC Uganda program, we use extensive program cost data from Bandiera 2015. Reported costs for the 3,964 girls in the treatment group include, office space and equipment, program management and staff compensation, training and refresher course costs for adolescent leaders, club materials and rent, and the direct costs of financial literacy and livelihood trainings for girls. We exclude the country and branch office overheads reported in the paper to be consistent with cost calculations across programs.

Intervention 5: Conditional Financial Incentives in Bangladesh

We have the most complete cost data for the cooking oil incentives in Bangladesh. Cost estimates include the costs of oil, monitors to confirm girls' marital status, transportation costs to deliver the cooking oil, and staff salaries of district point people, field officers, volunteers, and distribution workers.

The oil transfers were delivered through a food security program (Jibon-O-Jibika or JOJ) in the area that provided food transfers to pregnant and lactating mothers. JOJ's existing infrastructure led to cost-savings for the oil transfer program. We have estimated the program costs both including and excluding the benefit from working with an existing distribution partner.

We only consider costs and benefits for girls who were 15 at oil distribution start because they received the full program as would be the case if the program were scaled up. To estimate costs, we assume the costs for 15-year-old girls are proportional to the percentage of 15-year-old girls eligible for the program each year. We calculate all the costs, which is for aged 15 to 17, and then discount them to reflect the portion of girls who were 15 at the time of the oil distribution. This portion increases for each year as a result of girls aging out of the program. We consider costs and benefits for the 2,860 unmarried girls aged 15 in the 154 villages who were eligible for the oil incentive at the start of the oil distribution.

Intervention 6: Unconditional Cash Transfers in Malawi

For the UCT in Malawi, we estimate the number of girls eligible for the program by multiplying the average number of girls per enumeration area, the unit of randomization, by the total number of enumeration areas. Costs include the fixed and variable costs to distribute the transfers, the cost of a census to establish the number of eligible girls, as well as the value of the transfers themselves.

Net Present Value (NPV) per $1,000 Investment

We calculate the Net Present Value as the difference between the discounted benefits and the discounted costs of each program. Since the programs vary widely in terms of scale, the NPVs themselves are not directly comparable. The larger programs we consider have considerable larger NPVs, but only because they reached many more girls at scale. To aid in comparison of the programs, we divide the NPV by the total amount invested (costs to implementer and beneficiaries). We then present the NPV for each program in terms of NPV per $1,000 invested.

Benefit Cost Ratio

We present a benefit-cost ratio for each of the programs. For these calculations we divide the total NPV of the benefits of a program by the NPV of its costs. All discounting and conversions are calculated as described above.

Cost-Effectiveness Analysis

In addition to the CBA, we provide estimates of the cost-effectiveness of each program in terms of a variety of outcomes including child marriages averted, additional years of schooling, and years of

delayed marriage. These estimates are meant to give a sense of the relative efficiency of the programs at meeting particular outcomes without requiring the full set of assumptions of a CBA. To calculate the cost-effectiveness, we estimate the amount of a given outcome which would be achieved for a given investment.

For example, for child marriages averted, we first multiply the point estimate of reduction in underage marriage by the number of girls eligible by the program. This gives us the total number of child marriages averted by the program. We then divide the present value of the costs of the program by the number of child marriages averted to determine the cost per child marriage averted. We then divide 1,000 by the cost per child marriage averted to express the figure in terms of returns to a 1,000 USD investment.

For the oil incentive program, we present results both including and excluding foregone income as a cost. This allows us to show both the cost efficiency from the perspective of the implementer alone and for the implementer and beneficiary. For all cross-comparisons with other interventions, we include both foregone income and implementation costs.

Limitations of the Analysis

Our estimates of the returns to education are based on a standard Mincer equation which compares earnings for those women in the workforce with different levels of education. Two key assumptions are necessary for this to reflect the gains to the economy of increases in education. First, it assumes the high wages of those women who are more educated are the result only of their education and not due to unobservables (such as motivation) which may be correlated with higher than average education. Second, it assumes that women who are not in the workforce but have had more education have an equal increase in productivity in the work they do at home as those who are in the workforce. If there is selection of more able or more motivated women into education or if education raises productivity less for those not in the labor force then our estimates will overestimate the Net Present Value of all the programs discussed here.

Causal evidence shows the effects of child marriage on educational attainment. However, as discussed above, corollary links form the bulk of the evidence on other effects of child marriage. We may imagine a range of long-term benefits for adolescent girls who delay marriage in terms of improved health outcomes, higher household decision-making power, or intergenerational well-being. The lack of causal evidence on these channels along with the difficulty of monetizing their benefits severely limits what can be included in a cost-benefit analysis. As a result, when monetizing

benefits, we consider only the benefits of delayed marriage through the wage premium from increased years of schooling. We are therefore likely undervaluing the total benefits of each intervention.

Similarly, on the cost side, only the direct costs of each program and foregone wages are considered. We do not include costs associated with changes in the size or timing of dowries, for instance, or other less tangible benefits and costs that would require a large number of additional assumptions for which evidence is limited.

The availability of cost data varies across interventions. For the financial incentives in Bangladesh, school uniforms in Kenya, and vouchers in Colombia, we have extensive information about the actual costs of delivering the interventions. However, for the FSSAP programs in Bangladesh, we have estimates solely on the cost of the stipends themselves and thus have to estimate other costs. For the BRAC Uganda intervention, we have extensive records of the program costs, but only a rough estimates of the number of girls eligible. This makes true comparisons of the efficiencies of the programs difficult and may lead us to overestimate the cost effectiveness of the programs for which we have limited cost data. In particular, the high involvement of researchers in programs evaluated by RCTs may mean that cost data are collected more comprehensively making these programs appear costlier. In addition, those programs tested at small scale may have higher costs than they would if they were scaled up. We attempt to address this in at least one way by using the converted monitoring costs for programs for which we do not have monitoring cost estimates.

We are unable to take into account general equilibrium effects. Most importantly, if increases in education lead to a decline in the marginal return to education this would depress the benefits of all the interventions discussed here. Working in the other direction there may be social benefits to education not captured in Mincer regressions and even complementarities in the returns to additional education which would suggest our benefits are underestimates.

The dynamics of marriage are very different in South Asia than in Africa and Latin America where several of our comparative cases took place. Whereas parents in Bangladesh exercise significant control over their daughters' marriage-age decisions, in Malawi and Colombia girls have more influence on their own decisions. As a result, much of the evidence from regions outside of South Asia focus on teenage sexual activity or cohabitation rather than marriage. These differences make cross-comparisons difficult, and we may expect interventions to have very different results given the dynamics of each cultural context.

Results

Cost Benefit Analyses

We compare the net benefits of six programs with significant effects on child marriage. We compare the programs in terms of their cost effectiveness on increasing years unmarried, child marriages averted, and additional years of schooling using point estimates of the effects of each intervention. We then present benefit-cost ratios of each program first using the estimated education impacts from the individual evaluations, and second assuming the educational returns to delayed marriage from the financial incentives to delay marriage in Bangladesh. For interventions which took place outside of Bangladesh, we only present the latter results. Sensitivity analyses and more details on each intervention are included in the Appendix.

Figure 2: NPV/ $1,000 (cost to beneficiary & implementer), 5% discount rate

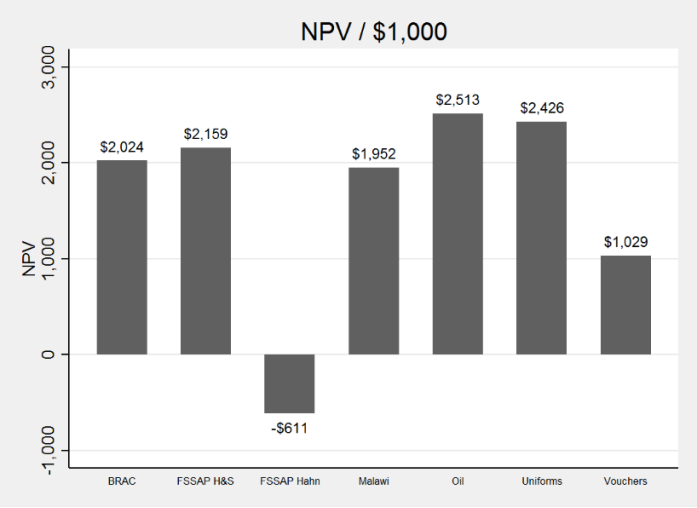


Figure 3: BCR (cost to beneficiary & implementer), 5% discount rate

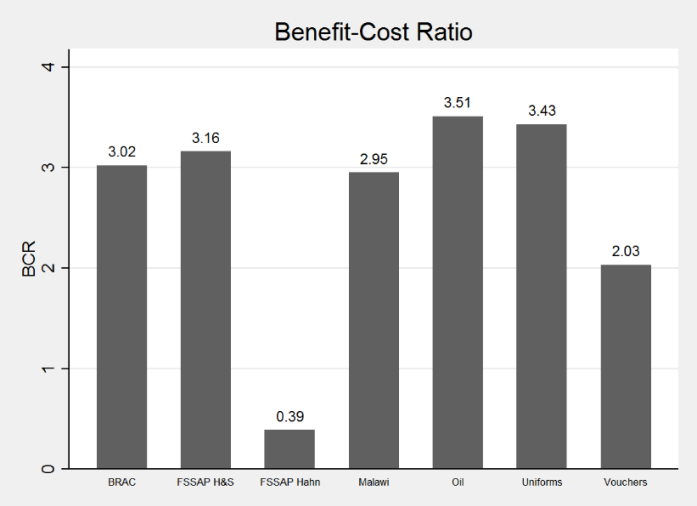


Figure 4: Years unmarried/$1,000 (cost to beneficiary & implementer), 5% discount rate

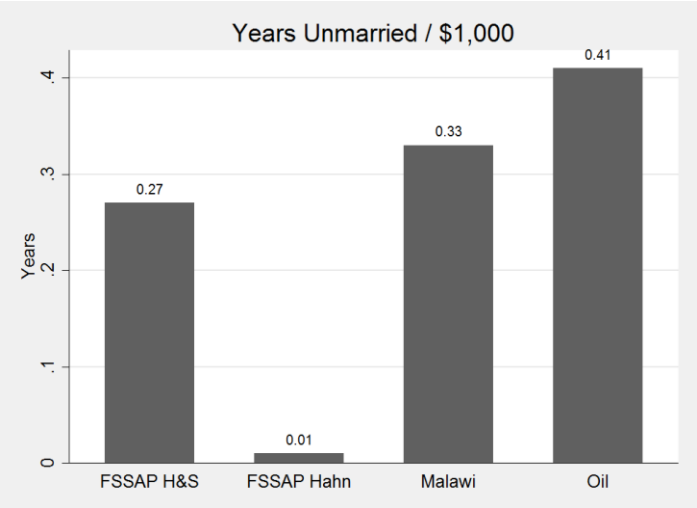
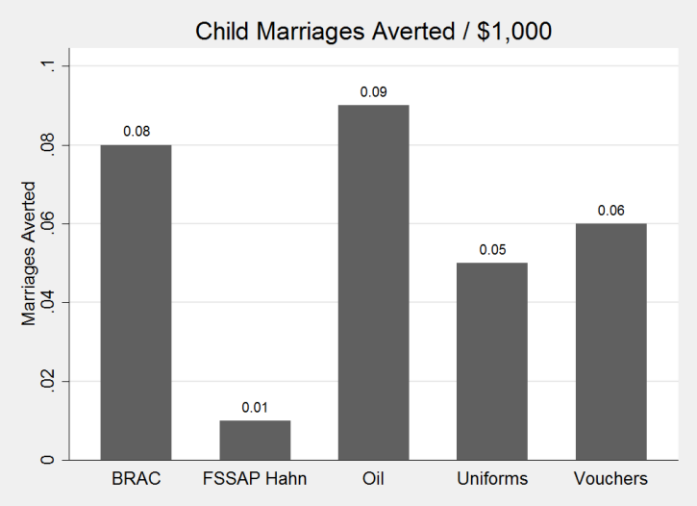


Figure 5: Child marriages averted/$1,000 (cost to beneficiary & implementer), 5% discount rate



In Figures 2 and 3, we compare all of the inventions using the education conversion coefficient from the oil incentives program in Bangladesh to simulate what the expected return to the program would be if they were implemented there. We present both the benefit-cost ratio of each program as well as results in NPV per $1,000 investment to control for the size of each program. Figures 4 and 5 compare the outcomes years unmarried and child marriages averted per $1,000. Not surprisingly, we observe a high correlation between the cost-effectiveness in marriage outcomes and cost-benefit.

Table 3: Summary of Cost-Effectiveness and Cost-Benefit Analysis, 5% Discount Rate

Intervention Type	Intervention	Location	Marriage Impact	Outcome Measure	Outcome per $1,000
Financial Incentive to Delay Marriage	Oil Incentive	Bangladesh	Yes	Additional years unmarried	0.41
				Child marriages averted	0.09
				Additional years of schooling	0.36
Incentives to Increase Girls' Education	Bangladesh Female Secondary School Assistance Program - Hahn et al.	Bangladesh	Yes	Additional years unmarried	0.01
				Child marriages averted	0.01
				Additional years of schooling	0.04
	- Hong and Sarr			Additional years unmarried	0.27
				Additional years of schooling	0.32
	Vouchers for Private Schools	Colombia	Yes	Child marriages averted	0.06
				Additional years of schooling	0.17
	Free School Uniforms	Kenya	Yes	Child marriages averted	0.05
				Additional years of schooling	0.35
	CCT in Malawi	Malawi	No	Additional years unmarried	0.00
Unconditional Cash Transfer	UCT in Malawi	Malawi	Yes	Additional years unmarried	0.33
				Additional years of schooling	0.29
Girls' Empowerment	Empowering Girls Through Life-Skills and Vocational Training (BRAC)	Uganda	Yes	Child marriages averted	0.08
				Additional years of schooling	0.32
	Empowering Girls Through Life-Skills and Vocational Training (BRAC)	Tanzania	No	Additional years unmarried	0.00

Table 4: Summary of Cost-Effectiveness and Cost-Benefit Analysis for Interventions with Estimated Marriage Impact, 5% Discount Rate

Intervention Type	Intervention	Location	Benefit-Cost Ratio		NPV per $1,000	
			Original Education Coefficient	Education Coefficient from Marriage Conversion	Original Education Coefficient	Education Coefficient from Marriage Conversion
Financial Incentive to Delay Marriage	Oil Incentive	Bangladesh	3.51	3.51	$2,513	$2,513
Incentives to Increase Girls' Education	Bangladesh Female Secondary School Assistance Program	Bangladesh				
	- Hahn et al.		3.44	0.39	$2,439	-$611
	- Hong and Sarr		3.73	3.16	$2,731	$2,159
	Vouchers for Private Schools	Colombia	1.54	2.03	$544	$1,029
	Free School Uniforms	Kenya	3.54	3.43	$2,540	$2,426
Unconditional Cash Transfer	UCT in Malawi	Malawi		2.95		$1,952
Girls Empowerment	Empowering Girls Through Life-Skills and Vocational Training (BRAC)	Uganda		3.02		$2,024

Discussion

In order to give a sense of the education wage premium benefits of each program if they were implemented in Bangladesh, we consider the benefit-cost ratios using the implied impacts from the oil incentive intervention. When comparing the programs, financial incentives to delay marriage appear to be more cost-effective than unconditional transfers to girls in school in Malawi. However, unconditional transfers in Kenya seem to have been very effective with a NPV of $2,426 per $1,000 invested – close to that of the oil incentive of $2,513 per $1,000 invested. We observe smaller results for financial incentives conditional on schooling in Colombia.

For the FSSAP, it is difficult to draw conclusions from the analysis. The point estimates on effects on age of marriage vary widely across evaluations. The point estimates range from no estimated effect (Heath and Mobarak 2015) to an increase of 1.432 years in age at first marriage (Hong and Sarr 2012). Therefore, when using the conversion factor for schooling, we observe vastly different cost-benefit outcomes for the two studies considered, -$611 for Hahn et al. and $2,159 for Hong and Sarr, leaving the CBA analysis without clear conclusions about the impact of the FSSAP program.

Large-scale transfer programs will have a relatively large effect in terms of BCR from their size, but much of the costs incurred by government are excluded because transfers, from the perspective of the economy as a whole, are considered on both the benefit and cost sides of the equation. As the size of the transfer increases the impact may increase but the costs do not rise because transfers are not a net cost to the economy. If transfers are netted out in this way, it is the ratio of administrative and overhead costs to the impacts of the program which drive the final BCR. The BCR is not the BCR from the point of view of a government investment, but from the welfare standpoint of society as a whole. This is particularly important for the analysis because we did not have access to monitoring costs for the largest transfer programs, the FSSAP and Colombia vouchers, and rely on estimates based on similar programs.

As a complement, the cost-effectiveness analysis gives a picture of what kind of return on investment a government may expect in terms of program impact. While the BCR gives us a sense of the overall benefit to society of a program, from the point of view of a potential investor in a program, the cost-effectiveness ratio may provide a better decision-making tool for deciding between potential interventions.

Conclusions

We provide analyses comparing approaches to reduce child marriage and raise education levels. There is very limited high quality evidence on the impact of conditional cash transfers on age of marriage particularly in South Asia where the dynamics of marriage are very different from Africa and Latin America. Additionally, the studies on this topic from South Asia are not as high quality and provide mixed evidence. This lack of rigorous research means there are few programs with child marriage as an outcome to which the cost-effectiveness of financial incentives in Bangladesh could be compared. Furthermore, cultural contexts make cross-comparison of the relative cost-effectiveness of these programs difficult. For example, in Uganda reducing underage pregnancy and cohabitation was a goal of the empowerment program whereas child marriage was the target of the same program in Bangladesh. Similar programs may have different outcomes when replicated in a new context. While the Bangladesh empowerment program alone did not translate into changes in marriage age or schooling, it may translate into gains in reproductive health outcomes or marital bargaining power at a later stage in a girl's life.

If child marriage is the primary target of a new program, our analyses suggest that providing direct financial incentives to girls is the most cost effective means to avert underage marriages. Our results complement the growing literature suggesting that incentives can help change long held behaviors. Transfers conditional on education have been criticized for failing to help the most marginal girls who cannot continue in school. Our results suggest a way to promote education that nonetheless helps out-of-school girls. Even the modest financial incentives in the form of cooking oil had large impacts on the marriage age of girls, and the program reached them regardless of whether they were in school or not. Since 20% of the girls are still in school, the long-term educational benefits of the program may be even larger. In the future, we will be able to measure the long-term effects and cost-effectiveness of the program. Even so, current analyses seem to suggest that a modest financial incentive to families to delay marriage of adolescent girls is cost-effective and can have important marriage and education impacts in Bangladesh.

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Appendix

Interventions Considered but not Included in the CBA

Appendix Table 1

High-quality Evaluations with no Reporting of Marriage Outcomes		
Intervention	Method of Estimation	Evaluation
Encouraging Education		
Reducing Distance to Schools in Afghanistan	RCT	Burde et al. (2013)
Conditional Cash and Noncash Transfers		
Apri Beti Apna Dhan (Haryana India)	instrument eligible	Sinah, Yoong (2009)
Girls Scholarship Program in Kenya	RCT	Kremer et al. (2009,2011)
PROGRESA in Mexico	RCT	Boyce and Gertler (2001), Schultz (2001), Behrman et al. 2004)

Appendix Table 2

Interventions Reporting Significant Effects on Marriage Excluded for Low Quality		
Intervention	Method of Estimation	Evaluation
Minimum Marriage Age Laws		
Marriage Laws in Sub-Saharan Africa	means comparison	Maswikwa et al. (2015)
Conditional Cash and Noncash Transfers		
Apri Beti Apna Dhan (Haryana India)	means comparison	Nanda et al. (2014)
Empowering Adolescent Girls		
Ishraq in Egypt	matched villages with self-selected treatment	Brady et al (2007)
Maharashtra Life Skills	RCT with only one treatment and comparison	Pande et al. (2006)
DISHA in India	propensity score matching	Kanesathasan et al. (2008)
BRAC Bangladesh	members vs nonmembers	Shahnaz and Karim (2008)
Empowering and Livelihood Training in Ethiopia	semi-experimental, matching	Erulkar and Multhengi (2009)

Sensitivity Analyses

Intervention 1: The Female School Stipend Program in Bangladesh

Appendix Table 3

FSSAP Cost Effectiveness - Hahn			
Measure	Conversion	Discount Rate	Outcome per $1000
Child marriages averted	No	3%	0.01
		5%	0.01
		10%	0.01
Additional years unmarried	No	3%	0.01
		5%	0.01
		10%	0.02
Additional years of schooling	No	3%	0.30
		5%	0.38
		10%	0.63
Additional years of schooling	Yes	3%	0.03
		5%	0.04
		10%	0.04

Appendix Table 4

FSSAP Cost Benefit - Hahn			
Conversion	Discount Rate	Benefit-Cost Ratio	NPV per $1000
No	3%	4.65	$3,649
	5%	3.44	$2,439
	10%	1.85	$846
Yes	3%	0.60	-$400
	5%	0.39	-$611
	10%	0.17	-$828

Appendix Table 5

FSSAP Cost Effectiveness - Hong & Sarr			
Measure	Conversion	Discount Rate	Outcome per $1000
Additional years unmarried	No	3%	0.21
		5%	0.27
		10%	0.43
Additional years of schooling	No	3%	0.30
		5%	0.38
		10%	0.62
Additional years of schooling	Yes	3%	0.26
		5%	0.32
		10%	0.49

Appendix Table 6

FSSAP Cost Effectiveness - Hong & Sarr			
Conversion	Discount Rate	Benefit-Cost Ratio	NPV per $1000
No	3%	5.07	$4,074
	5%	3.73	$2,731
	10%	1.97	$974
Yes	3%	4.42	$3,419
	5%	3.16	$2,159
	10%	1.59	$588

Intervention 2: Vouchers for Private Education in Colombia

Appendix Table 7

Colombia Cost Effectiveness			
Measure	Conversion	Discount Rate	Outcome per $1000
Child marriages averted	No	3%	0.05
		5%	0.06
		10%	0.06
Additional years of schooling	No	3%	0.10
		5%	0.11
		10%	0.13
Additional years of schooling	Yes	3%	0.15
		5%	0.17
		10%	0.21

Appendix Table 8

Colombia Cost Benefit			
Conversion	Discount Rate	Benefit-Cost Ratio	NPV per $1000
No	3%	2.12	$1,124
	5%	1.54	$544
	10%	0.96	-$44
Yes	3%	2.87	$1,865
	5%	2.03	$1,029
	10%	1.13	$135

Intervention 3: Free School Uniforms in Kenya

Appendix Table 9

Kenya Uniforms Cost Effectiveness			
Measure	Conversion	Discount Rate	Outcome per $1000
Child marriages averted	No	3%	0.04
		5%	0.05
		10%	0.08
Additional years of schooling	No	3%	0.30
		5%	0.37
		10%	0.55
Additional years of schooling	Yes	3%	0.29
		5%	0.35
		10%	0.52

Appendix Table 10

Kenya Uniforms Cost Benefit			
Conversion	Discount Rate	Benefit-Cost Ratio	NPV $1000
No	3%	4.90	$3,900
	5%	3.54	$2,540
	10%	1.85	$849
Yes	3%	4.76	$3,764
	5%	3.43	$2,426
	10%	1.79	$794

Intervention 4: Empowering Adolescent Girls in Uganda

Appendix Table 11

BRAC Uganda Cost Effectiveness			
Measure	Conversion Factor	Discount Rate	Outcome per $1000
Child marriages averted	No	3%	0.07
		5%	0.08
		10%	0.11
Additional years of schooling	Yes	3%	0.26
		5%	0.32
		10%	0.45

Appendix Table 12

BRAC Uganda Cost Benefit			
Conversion Factor	Discount Rate	Benefit-Cost Ratio	NPV per $1000
Yes	3%	4.31	$3,307
	5%	3.02	$2,024
	10%	1.47	$467

Intervention 5: Conditional Financial Incentives in Bangladesh

Appendix Table 13

Bangladesh Oil Incentive Cost Effectiveness				
Measure	Benefitting from JOJ infrastructure	Discount Rate	Outcome per $1000	Without foregone income
Additional years unmarried	Yes	3%	0.34	5.07
		5%	0.41	5.16
		10%	0.62	5.38
	No	3%	0.34	4.53
		5%	0.41	4.60
		10%	0.61	4.79
Child marriages averted	Yes	3%	0.07	1.09
		5%	0.09	0.09
		10%	0.13	1.15
	No	3%	0.07	0.97
		5%	0.09	0.99
		10%	0.13	1.03
Additional years of schooling	Yes	3%	0.29	4.36
		5%	0.36	0.36
		10%	0.53	4.63
	No	3%	0.29	3.89
		5%	0.35	3.96
		10%	0.53	4.12

Appendix Table 14

Bangladesh Oil Incentive Cost Benefit			
Benefitting from JOJ infrastructure	Discount Rate	Outcome per $1000	NPV per $1000
Yes	3%	4.84	$3,844
	5%	3.51	$2,513
	10%	1.89	$892
No	3%	4.81	$3,806
	5%	3.48	$2,479
	10%	1.87	$865

Intervention 6: Unconditional Cash Transfers in Malawi

Appendix Table 15

Malawi UCT Cost Effectiveness			
Measure	Conversion factor	Discount Rate	Outcome per $1000
Additional years unmarried	No	3%	0.28
		5%	0.33
		10%	0.46
Additional years of schooling	Yes	3%	0.24
		5%	0.29
		10%	0.39

Appendix Table 16

Malawi UCT Cost Benefit			
Conversion factor	Discount Rate	Benefit-Cost Ratio	NPV per $1000
Yes	3%	4.15	$3,147
	5%	2.95	$1,952
	10%	1.55	$553

Bangladesh, like most nations, faces a large number of challenges. What should be the top priorities for policy makers, international donors, NGOs and businesses? With limited resources and time, it is crucial that focus is informed by what will do the most good for each taka spent. The Bangladesh Priorities project, a collaboration between Copenhagen Consensus and BRAC, works with stakeholders across Bangladesh to find, analyze, rank and disseminate the best solutions for the country. We engage Bangladeshis from all parts of society, through readers of newspapers, along with NGOs, decision makers, sector experts and businesses to propose the best solutions. We have commissioned some of the best economists from Bangladesh and the world to calculate the social, environmental and economic costs and benefits of these proposals. This research will help set priorities for the country through a nationwide conversation about what the smart - and not-so-smart - solutions are for Bangladesh's future.

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