Online Appendix

A Signal to End Child Marriage: Theory and Experimental Evidence from Bangladesh

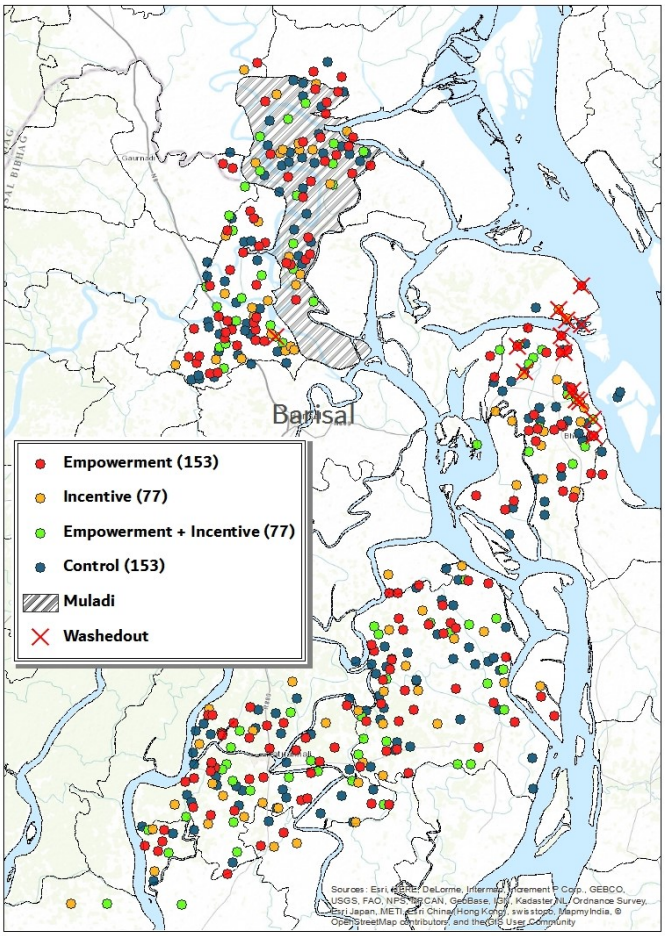
Nina Buchmann, Erica Field, Rachel Glennerster, Shahana Nazneen, Xiao Yu Wang

Contents

OA.1 Program Information

OA.1.1 Treatment Region

Figure OA.1: Communities by Treatment Status



Notes: The figure presents the geolocations of all communities included in our study as well as their treatment status. We highlight communities in Muladi, in which rumors spread at midline, as well as washedout communities, in which some households were completely washedout and thus excluded from this study.

OA.1.2 Community Summary Statistics

Table OA.1: Community Characteristics (N=460)

	Mean	S.D.
Number of households in community	350.9	205.4
Closest motorable road >1hr away (%)	16.2	36.9
Primary school in community (%)	50.9	50.0
Secondary school in community (%)	24.6	43.1
Community has at least 1 matchmaker (%)	94.6	22.6
3 or more matchmakers in community (%)	70.2	45.8

Notes: The data come from the following sources: Panel A: "Number of households in community" from the baseline parents' survey; "Closest motoroble road>1hr away", "Primary school in community" and "Secondary school in community" from the baseline village leader survey; "Community has at least 1 local matchmaker" and "3 or more matchmakers in community" from the endline matchmaker survey.

OA.1.3 Randomization

Prior to randomization, the list of communities was organized in two steps:

1. Communities were organized by the number of girls age 10 to 19 at baseline.
2. Size tiers of communities were determined and communities then ordered by unionIDs and size tiers, whereby the order of communities within union and size tiers was random.

First, the number of multiples of 6 was determined per union as this was the number of randomizations to be performed per union (each treatment status was related to one number with the empowerment and control arms being assigned two numbers).

Then, in each union, the treatment status of the first community was randomized. The treatment status of the following communities was assigned in the sequence of 1-6 (e.g., if the first community was randomly assigned treatment 3, the subsequent communities were assigned treatments 4,5,6,1 etc.).

Lastly, all remainder communities in excess of the multiples of 6 were ordered by unions and tiers and the treatment status of the first community assigned by randomization and of all subsequent remainder communities by filling the sequence 1-6.

OA.1.4 Take-Up

Table OA.2: Take-Up, calculated from monitoring data and self-reported data

Treatment Group	**Empowerment Membership** (%)		**Incentive Take-Up Cardholders** (%)	
	Admin.	Self-Reported	Admin.	Self-Reported
Empowerment	90.6	50.3	.	.
Incentive	.	18.8	90.3	76.6
Empowerment+Incentive	96.7	66.1	93.1	84.1
Control	.	10.9	.	.
Any Empowerment	92.7	55.9	.	84.1
Any Incentive	.	42.9	91.8	80.6

Notes: To calculate the empowerment take-up from monitoring data, we divide the number of distinct girls on the KK enrollment sheets in each community by the number of eligible girls in each community (age 10-19 at baseline). The incentive take-up among cardholders is the share of girls who were handed an incentive pick-up card who were listed on the incentive pick-up sheets. The self-reported take-up is the mean of unmarried and eligible girls (age 10-19 at baseline for the empowerment program and age 15-17 at program start for the incentive program) who reported at midline (2011) that they were enrolled in KK (had attended at least 1 KK session), or received the incentive at least once. Reported incentive take-up among cardholders is the reported mean among girls who were handed an incentive pick-up card.

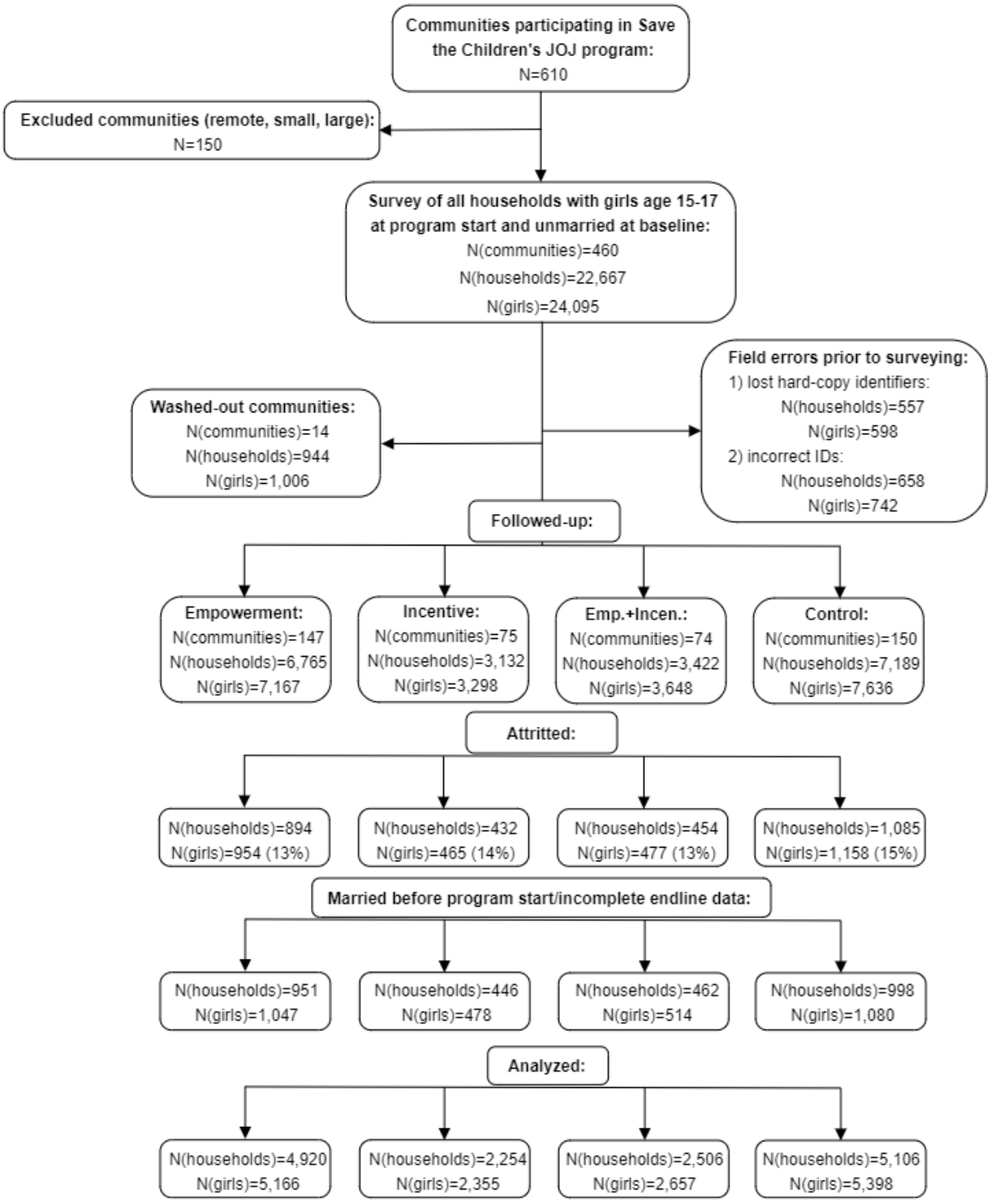
Table OA.3: Baseline characteristics, by whether or not the woman picked up the incentive at least once or reported to have been a KK member, women age 15-17 at program start and unmarried at baseline

	Received Oil (92%)		**KK Member (49%)**	
N	494	5,548	1,716	807
	Mean (SD)	β_{Oil} (p-val)	Mean (SD)	β_{Empow} (p-val)
Age	15.1	-0.2	14.9	-0.0
	(0.8)	(0.00)	(0.8)	(0.70)
Still in-school (%)	46.0	23.0	68.7	7.7
	(49.9)	(0.00)	(46.4)	(0.00)
Unmarried older sister in HH (%)	13.0	6.7	16.7	2.7
	(33.6)	(0.00)	(37.3)	(0.10)
Mother education (0-17)	2.4	0.6	3.2	0.2
	(2.9)	(0.00)	(3.2)	(0.25)
HH size (members)	6.2	-0.1	5.7	0.1
	(2.1)	(0.23)	(1.9)	(0.51)
Community is connected to public transport (%)	35.0	1.7	38.7	-4.7
	(47.8)	(0.74)	(48.7)	(0.16)
Distance closest village center (meters)	1050.2	-33.6	984.3	-59.4
	(657.5)	(0.56)	(648.2)	(0.18)
Distance closest village center from HH (meters)	.	.	675.6	-25.7
			(1140.3)	(0.61)
Distance to closest safe space from HH (meters)	.	.	812.5	-326.2
			(1354.0)	(0.00)
BMI	.	.	19.7	-1.1
			(44.1)	(0.34)
Stunted (%)	.	.	30.4	0.2
			(46.0)	(0.93)
Monthly HH income (USD)	.	.	20.2	0.3
			(15.8)	(0.74)

Notes: The table shows baseline characteristics by take-up of the interventions of women age 15-17 at program start and unmarried at baseline. We show means and standard deviations within treatment arms as well as regression coefficients and p-values on the take-up indicators in OLS regressions with modified Huber-White SEs clustered at the community level. We use administrative data on take-up from the oil incentive and reported membership of the empowerment program in the 2011 young women's survey.

OA.1.5 Consort Diagram

Figure OA.2: Communities, households, and girls included in the study



OA.1.6 Attrition

Table OA.4: Attritted, unmarried women age 15-17 at program start

	Parents' Survey		Young Women's Survey	
	(1)	(2)	(3)	(4)
Empowerment	-0.019	-0.019	0.010	0.010
	(0.012)	(0.012)	(0.019)	(0.019)
Incentive	-0.011	-0.011	-0.027	-0.024
	(0.014)	(0.014)	(0.019)	(0.019)
Incen.+Empow.	-0.021	-0.021	-0.011	-0.012
	(0.015)	(0.015)	(0.019)	(0.019)
Age		-0.002		-0.003
		(0.003)		(0.007)
Still in-school		-0.031		-0.042
		(0.006)		(0.015)
Unmarried older sister in HH		-0.001		-0.001
		(0.007)		(0.016)
Mother education		0.002		0.003
		(0.001)		(0.003)
HH size (members)		-0.008		0.003
		(0.002)		(0.004)
Community connected to public transport		0.000		0.010
		(0.010)		(0.015)
BMI				-0.000
				(0.000)
Stunted				0.016
				(0.014)
HH income (100 USD)				1.057
				(3.174)
Control Mean	0.152	0.152	0.125	0.125
Observations	21,749	21,749	2,748	2,748

Notes: The table shows results from OLS regressions with modified Huber-White SEs clustered at the community level. The sample includes women age 15-17 at program start and unmarried at baseline and excludes women for which tracking data was lost at baseline as well as washed-out households.

Table OA.5: Attritted, women age 15-17 at program start and unmarried at baseline

	Parents' Survey		Young Women's Survey	
	(1)	(2)	(3)	(4)
Empowerment	0.000	0.002	0.022	0.021
	(0.028)	(0.028)	(0.024)	(0.023)
Incentive	0.040	0.041	-0.028	-0.024
	(0.039)	(0.038)	(0.021)	(0.021)
Incen.+Empow.	0.000	0.001	-0.018	-0.018
	(0.033)	(0.033)	(0.021)	(0.021)
Age		-0.005		-0.001
		(0.004)		(0.008)
Still in-school		-0.045		-0.041
		(0.009)		(0.016)
Unmarried older sister in HH		0.004		-0.004
		(0.007)		(0.016)
Mother education		-0.000		0.002
		(0.002)		(0.003)
HH size (members)		-0.001		0.008
		(0.002)		(0.004)
Community connected to public transport		-0.038		0.000
		(0.022)		(0.017)
BMI				-0.000
				(0.000)
Stunted				0.023
				(0.014)
HH income (100 USD)				0.016
				(0.033)
Control Mean	0.204	0.204	0.135	0.135
Observations	24,095	24,095	2,791	2,791

Notes: The table shows results from OLS regressions with modified Huber-White SEs clustered at the community level. The sample includes women age 15-17 at program start.

OA.1.7 Verification of Marriage Age

Table OA.6: Marriage age checks, using verified reports and marriage certificates. Women age 15-17 and unmarried at program start

	Empowerment			**Incentive**			**Empow.+Incen.**			**Control**		**Total**	
	Mean	S.D.	Diff.	Mean	S.D.	Diff.	Mean	S.D.	Diff.	Mean	S.D.	Mean	S.D.
Parents' - girls':	1.6	15.2	0.2	1.4	16.7	0.1	1.8	14.8	0.5	1.4	15.4	1.5	15.5
Parents' - certificates:	-4.8	20.4	-5.0	2.0	5.0	1.8	-0.7	6.6	-0.9	0.3	15.3	-1.3	15.6
Girls' - certificates:	-5.7	21.9	3.4	-6.5	28.1	2.6	-0.8	6.5	8.3	-9.1	30.9	-6.4	25.2

Notes: The table shows the difference in months between different ways to calculate age at first marriage, by treatment arm. For each treatment arm, the differences between surveys are compared to the difference between surveys in the control arm. We collected marriage certificates in a subsample of households in the subsample interviews of young women. We thus have three measures of marriage age: Marriage age as calculated using the date reported on the marriage certificate, marriage age as reported by the parents, and marriage age as reported by the women themselves in a random subsample. No differences from OLS regressions with Huber-White robust SEs clustered at the community level differ significantly by treatment arm.

OA.1.8 Knowledge about the Incentive Program in Non-Incentive Communities

Table OA.7: Share of girls who have heard about the incentive

	Treated girl in incentive village	Untreated girl in incentive village	Untreated girl in non-incentive village	
Distance to closest incentive village:			<= 500 meters	> 500 meters
Girl heard about incentive (%)	97.04	79.11	34.56	24.49
SD	16.96	40.67	47.64	43.01
N	541	1230	272	2985

Notes: The table shows the mean of girls age 10-17 and unmarried at program start in the women's survey who were followed up at endline and reported at midline having heard about the incentive program. We show means for treated girls in incentive villages (received an incentive pick-up card), untreated girls in incentive villages (did not receive an incentive pick-up card) and untreated girls in non-incentive villages, split up by whether or not the village center was within 500 meters of an incentive village center at baseline.

OA.2 Empirical Appendix

OA.2.1 Robustness Checks

Table OA.8: Marriage outcomes, unmarried women age 15-17 at program start, excluding controls

	Married<18		Married<16	Ever married at midline		Ever married at endline		Marriage age		Birth<20	
	Age 15-17	Age 15	Age 15	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Empowerment	-0.009	-0.004	0.007	0.012	0.015	0.005	0.001	0.022	-0.007	0.005	0.006
	(0.008)	(0.016)	(0.009)	(0.012)	(0.017)	(0.008)	(0.012)	(0.043)	(0.068)	(0.008)	(0.013)
Incentive	-0.047	-0.072	-0.019	-0.018	-0.049	-0.005	-0.016	0.214	0.316	-0.014	-0.037
	(0.011)	(0.020)	(0.012)	(0.013)	(0.019)	(0.011)	(0.016)	(0.060)	(0.082)	(0.010)	(0.017)
Incen.*Empow.	0.020	0.018	-0.007	-0.019	-0.010	-0.005	0.000	-0.062	-0.054	-0.001	0.004
	(0.016)	(0.028)	(0.017)	(0.020)	(0.028)	(0.014)	(0.022)	(0.085)	(0.123)	(0.016)	(0.025)
Control Mean	0.293	0.385	0.113	0.458	0.415	0.837	0.820	18.969	18.293	0.241	0.326
Observations	15,549	5,861	5,861	14,891	5,604	15,562	5,864	12,993	4,773	15,494	5,847
FE	Union	Union	Union	Union	Union	Union	Union	Union	Union	Union	Union
Age 15-17 vs 15:											
Empowerment		0.725			0.828		0.686		0.605		0.900
Incentive		0.083			0.031		0.330		0.119		0.054
Incen.*Empow.		0.945			0.660		0.741		0.931		0.773

Notes: The table shows results from OLS regressions with Huber-White robust SEs clustered at the community level. Columns (1)-(3) and columns (6)-(11) present results from the endline parents' survey and columns (4)-(5) show results from the midline parents' survey. The sample includes all women age 15-17 and unmarried at program start. The sample excludes washedout households as well as households with insufficient tracking data. "Empowerment" is an indicator that is 1 if the woman lived in any of the empowerment communities (empowerment only or empowerment plus incentive) and "Incentive" is an indicator that is 1 if the woman lived in any of the incentive communities (incentive only or empowerment plus incentive). The regressions control for strata (whether the community is in the first, second, or third tercile in terms of number of houses in the community and union fixed-effects). The bottom three rows present p-values from cross-equation equality tests of the coefficients for girls age 15-17 and girls age 15 at program start for each of the interventions.

Table OA.9: Marriage outcomes, women age 15-17 at program start and unmarried at baseline, including women married before program start

	Married<18		Married<16	Ever married at midline		Ever married at endline		Marriage age		Birth<20	
	Age 15-17	Age 15	Age 15	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Empowerment	-0.010	-0.005	0.008	0.009	0.011	0.003	-0.003	0.025	-0.011	0.001	0.008
	(0.008)	(0.014)	(0.011)	(0.010)	(0.015)	(0.007)	(0.010)	(0.046)	(0.075)	(0.008)	(0.012)
Incentive	-0.064	-0.080	-0.031	-0.030	-0.058	-0.020	-0.027	0.313	0.367	-0.032	-0.041
	(0.011)	(0.018)	(0.015)	(0.011)	(0.016)	(0.010)	(0.014)	(0.065)	(0.099)	(0.010)	(0.016)
Incen.*Empow.	0.010	0.005	-0.029	-0.006	-0.001	-0.003	0.005	0.030	0.097	-0.005	-0.015
	(0.016)	(0.025)	(0.020)	(0.016)	(0.023)	(0.013)	(0.020)	(0.090)	(0.140)	(0.015)	(0.023)
Control Mean	0.405	0.453	0.213	0.560	0.499	0.863	0.840	18.152	17.639	0.330	0.387
Observations	18,668	6,698	6,698	18,176	6,491	18,681	6,701	15,995	5,565	18,604	6,679
FE	Union	Union	Union	Union	Union	Union	Union	Union	Union	Union	Union
Age 15-17 vs 15:											
Empowerment		0.645			0.834		0.444		0.554		0.471
Incentive		0.270			0.030		0.495		0.508		0.456
Incen.*Empow.		0.812			0.773		0.539		0.557		0.570

Notes: The table shows results from OLS regressions, adjusted for baseline characteristics and stratification (see notes to table 2 in the main paper), with Huber-White robust SEs clustered at the community level. Columns (1)-(3) and columns (6)-(11) present results from the endline parents' survey and columns (4)-(5) show results from the midline parents' survey. The sample includes all women age 15-17 at program start and unmarried at baseline (we do not drop women married before the program start). The sample excludes washedout households as well as households with insufficient tracking data. "Empowerment" is an indicator that is 1 if the woman lived in any of the empowerment communities (empowerment only or empowerment plus incentive) and "Incentive" is an indicator that is 1 if the woman lived in any of the incentive communities (incentive only or empowerment plus incentive). The bottom three rows present p-values from cross-equation equality tests of the coefficients for girls age 15-17 and girls age 15 at program start for each of the interventions.

Table OA.10: Marriage outcomes, unmarried women age 15-17 at program start, including womenr assignment errors

	Married<18		Married<16	Ever married at midline		Ever married at endline		Marriage age		Birth<20	
	Age 15-17	Age 15	Age 15	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Empowerment	-0.007	-0.005	0.006	0.011	0.009	0.006	0.002	0.012	0.001	0.006	0.006
	(0.008)	(0.015)	(0.009)	(0.011)	(0.017)	(0.008)	(0.012)	(0.040)	(0.064)	(0.007)	(0.013)
Incentive	-0.060	-0.090	-0.024	-0.030	-0.064	-0.012	-0.022	0.260	0.389	-0.019	-0.048
	(0.012)	(0.023)	(0.014)	(0.016)	(0.023)	(0.013)	(0.019)	(0.063)	(0.096)	(0.012)	(0.019)
Incen.*Empow.	0.025	0.037	-0.002	-0.013	0.010	-0.002	0.007	-0.070	-0.116	-0.002	0.015
	(0.017)	(0.031)	(0.019)	(0.022)	(0.030)	(0.017)	(0.025)	(0.089)	(0.139)	(0.017)	(0.027)
Control Mean	0.293	0.385	0.113	0.458	0.415	0.837	0.820	18.969	18.293	0.241	0.326
Observations	15,549	5,861	5,861	14,891	5,604	15,562	5,864	12,993	4,773	15,494	5,847
FE	Union	Union	Union	Union	Union	Union	Union	Union	Union	Union	Union
Age 15-17 vs 15:											
Empowerment		0.858			0.885		0.676		0.850		0.994
Incentive		0.086			0.070		0.483		0.129		0.097
Incen.*Empow.		0.613			0.363		0.631		0.685		0.449

Notes: The table shows results from 2SLS regressions (instrumenting being listed on an incentive list by program assignment), adjusted for baseline characteristics and stratification (see notes to table 2 in the main paper), with Huber-White robust SEs clustered at the community level. Columns (1)-(3) and columns (6)-(11) present results from the endline parents survey and columns (4)-(5) show results from the midline parents survey. The sample includes all women age 15-17 and unmarried at program start. The sample excludes washedout households as well as households with insufficient tracking data. "Empowerment" is an indicator that is 1 if the woman lived in any of the empowerment communities (empowerment only or empowerment plus incentive) and "Incentive" is an indicator that is 1 if the woman was handed an incentive pick-up card, it is instrumented by assignment to the incentive treatment. "Empow.*Incen." is the interaction between assignment to the empowerment treatment and being handed an incentive pick-up card, it is instrumented by the interaction of assignment to the empowerment treatment and assignment to the incentive treatment. The bottom three rows present p-values from cross-equation equality tests of the coefficients for girls age 15-17 and girls age 15 at program start for each of the interventions.

Table OA.11: Education outcomes, unmarried women age 15-17 at program start and in school at baseline, excluding controls

	In school at midline		In school at endline		Last class passed		Secondary complete	
	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Empowerment	0.012	0.016	0.019	0.028	0.226	0.222	0.021	0.022
	(0.013)	(0.020)	(0.012)	(0.017)	(0.099)	(0.134)	(0.013)	(0.019)
Incentive	0.023	0.084	0.016	0.048	0.082	0.244	0.013	0.038
	(0.015)	(0.024)	(0.017)	(0.023)	(0.133)	(0.208)	(0.018)	(0.026)
Incen.*Empow.	0.022	-0.004	0.011	-0.017	-0.080	-0.183	-0.005	-0.019
	(0.023)	(0.032)	(0.023)	(0.031)	(0.198)	(0.264)	(0.026)	(0.036)
Control Mean	0.466	0.482	0.280	0.278	11.337	10.833	0.444	0.406
Observations	10,226	4,272	10,930	4,545	10,857	4,518	10,857	4,518
FE	Union	Union	Union	Union	Union	Union	Union	Union
Age 15-17 vs 15:								
Empowerment		0.767		0.357		0.956		0.965
Incentive		0.000		0.028		0.179		0.102
Incen.*Empow.		0.242		0.147		0.493		0.516

Notes: The table shows results from OLS regressions with Huber-White robust SEs clustered at the community level. Columns (1)-(2) present results from the midline parents survey and columns (3)-(8) show results from the endline parents survey. The sample includes all women age 15-17 and unmarried at program start and in school at baseline. The sample excludes washedout households as well as households with insufficient tracking data. "Empowerment" is an indicator that is 1 if the woman lived in any of the empowerment communities (empowerment only or empowerment plus incentive) and "Incentive" is an indicator that is 1 if the woman lived in any of the incentive communities (incentive only or empowerment plus incentive). The regressions control for strata (whether the community is in the first, second, or third tercile in terms of number of houses in the community and union fixed-effects). The bottom three rows present p-values from cross-equation equality tests of the coefficients for girls age 15-17 and girls age 15 at program start for each of the interventions.

Table OA.12: Education outcomes, women age 15-17 at program start and and unmarried and in school at baseline, including women married before program start

	In school at midline		In school at endline		Last class passed		Secondary complete	
	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Empowerment	0.007	0.006	0.017	0.027	0.177	0.199	0.016	0.018
	(0.011)	(0.018)	(0.011)	(0.015)	(0.089)	(0.123)	(0.012)	(0.017)
Incentive	0.033	0.089	0.028	0.046	0.097	0.168	0.018	0.031
	(0.014)	(0.021)	(0.015)	(0.019)	(0.121)	(0.185)	(0.015)	(0.023)
Incen.*Empow.	0.010	0.002	0.007	-0.014	-0.019	-0.036	-0.001	-0.003
	(0.020)	(0.029)	(0.021)	(0.028)	(0.180)	(0.242)	(0.024)	(0.032)
Control Mean	0.399	0.429	0.254	0.259	11.062	10.580	0.408	0.378
Observations	11,895	4,779	12,406	4,998	12,330	4,971	12,330	4,971
FE	Union	Union	Union	Union	Union	Union	Union	Union
Age 15-17 vs 15:								
Empowerment		0.916		0.311		0.793		0.866
Incentive		0.000		0.171		0.508		0.340
Incen.*Empow.		0.698		0.217		0.904		0.894

Notes: The table shows results from OLS regressions, adjusted for baseline characteristics and stratification (see notes to table 2 in the main paper), with Huber-White robust SEs clustered at the community level. Columns (1)-(2) present results from the midline parents survey and columns (3-(8) show results from the endline parents survey. The sample includes all women age 15-17 at program start and unmarried and in school at baseline (we do not drop women married before the program start). The sample excludes households with insufficient tracking data. "Empowerment" is an indicator that is 1 if the woman lived in any of the empowerment communities (empowerment only or empowerment plus incentive) and "Incentive" is an indicator that is 1 if the woman lived in any of the incentive communities (incentive only or empowerment plus incentive). The bottom three rows present p-values from cross-equation equality tests of the coefficients for girls age 15-17 and girls age 15 at program start for each of the interventions.

Table OA.13: Education outcomes, unmarried women age 15-17 at program start and in school at baseline, correcting for assignment errors

	In school at midline		In school at endline		Last class passed		Secondary complete	
	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15	Age 15-17	Age 15
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Empowerment	0.011	0.012	0.014	0.023	0.174	0.158	0.016	0.015
	(0.013)	(0.019)	(0.011)	(0.016)	(0.091)	(0.122)	(0.012)	(0.017)
Incentive	0.036	0.102	0.028	0.060	0.156	0.300	0.024	0.048
	(0.018)	(0.026)	(0.019)	(0.025)	(0.141)	(0.220)	(0.019)	(0.028)
Incen.*Empow.	0.015	-0.010	0.007	-0.024	-0.089	-0.204	-0.008	-0.022
	(0.026)	(0.034)	(0.025)	(0.034)	(0.209)	(0.279)	(0.028)	(0.038)
Control Mean	0.466	0.482	0.280	0.278	11.337	10.833	0.444	0.406
Observations	10,226	4,272	10,930	4,545	10,857	4,518	10,857	4,518
FE	Union	Union	Union	Union	Union	Union	Union	Union
Age 15-17 vs 15:								
Empowerment		0.928		0.505		0.864		0.945
Incentive		0.001		0.094		0.310		0.250
Incen.*Empow.		0.372		0.233		0.542		0.612

Notes: The table shows results from 2SLS regressions (instrumenting being listed on an incentive list by program assignment), adjusted for baseline characteristics and stratification (see notes to table 2 in the main paper), with Huber-White robust SEs clustered at the community level. Columns (1)-(2) present results from the midline parents survey and columns (3)-(8) show results from the endline parents survey. The sample includes all women age 15-17 and unmarried at program start and in school at baseline. The sample excludes washedout households as well as households with insufficient tracking data. "Empowerment" is an indicator that is 1 if the woman lived in any of the empowerment communities (empowerment only or empowerment plus incentive) and "Incentive" is an indicator that is 1 if the woman was handed an incentive pick-up card, it is instrumented by assignment to the incentive treatment. "Empow.*Incen." is the interaction between assignment to the empowerment treatment and being handed an incentive pick-up card, it is instrumented by the interaction of assignment to the empowerment treatment and assignment to the incentive treatment. The bottom three rows present p-values from cross-equation equality tests of the coefficients for girls age 15-17 and girls age 15 at program start for each of the interventions.

OA.2.2 Heterogeneity

Table OA.14: Marriage and education outcomes, unmarried women age 15-17 at program start, by whether woman was in or out of school at baseline

	Girl out of school					Girl in school				
	Married<18	Still in school	Last class passed	Dowry	Denmeher	Married<18	Still in school	Last class passed	Dowry	Denmeher
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Empowerment	0.002	-0.002	0.048	9.448	-67.455	-0.010	0.014	0.174	74.996	28.988
	(0.015)	(0.007)	(0.117)	(28.696)	(116.932)	(0.009)	(0.011)	(0.091)	(27.276)	(53.972)
Incentive	-0.015	-0.001	0.039	-19.591	9.161	-0.060	0.023	0.129	29.348	50.272
	(0.021)	(0.009)	(0.182)	(32.625)	(134.901)	(0.013)	(0.015)	(0.117)	(32.682)	(66.966)
Incen.*Empow.	-0.000	-0.011	-0.009	21.142	39.030	0.022	0.007	-0.071	-72.401	8.320
	(0.029)	(0.012)	(0.230)	(45.806)	(178.616)	(0.017)	(0.022)	(0.179)	(46.877)	(92.615)
Control Mean	0.359	0.038	5.698	644.472	2009.988	0.266	0.280	11.337	995.927	2288.319
Observations	4,615	4,628	4,597	3,712	455	10,933	10,930	10,857	8,081	2,041
FE	Union	Union	Union	Union	Union	Union	Union	Union	Union	Union

Notes: The table shows results from OLS regressions, adjusted for baseline characteristics and stratification (see notes to table 2 in the main paper), with Huber-White robust SEs clustered at the community level.

Table OA.15: Marriage and education outcomes, unmarried women age 15-17 at program start, by whether mother had received any schooling at baseline

	Mother not schooled					Mother schooled				
	Married<18	Still in school	Last class passed	Dowry	Denmeher	Married<18	Still in school	Last class passed	Dowry	Denmeher
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Empowerment	-0.013	0.024	0.192	62.203	129.222	-0.023	0.004	0.161	49.822	-167.918
	(0.015)	(0.016)	(0.177)	(33.278)	(154.990)	(0.013)	(0.016)	(0.115)	(34.876)	(141.417)
Incentive	-0.069	0.040	0.245	25.339	434.071	-0.067	-0.004	-0.048	17.412	-0.372
	(0.018)	(0.025)	(0.242)	(38.459)	(175.278)	(0.018)	(0.022)	(0.165)	(43.725)	(151.563)
Incen.*Empow.	0.069	-0.059	-0.573	-105.538	-569.324	0.024	0.023	0.176	-59.963	122.798
	(0.028)	(0.036)	(0.352)	(56.749)	(247.483)	(0.023)	(0.030)	(0.222)	(60.812)	(201.821)
Control Mean	0.360	0.163	10.039	703.718	2078.015	0.286	0.348	12.015	1026.872	2515.429
Observations	4,068	2,382	2,372	3,259	325	6,009	4,823	4,779	4,514	465
FE	Union	Union	Union	Union	Union	Union	Union	Union	Union	Union

Notes: The table shows results from OLS regressions, adjusted for baseline characteristics and stratification (see notes to table 2 in the main paper), with Huber-White robust SEs clustered at the community level.

OA.2.3 Social Conservatism

Formation of Index The social conservatism index is the mean across four indices: 1) ever married index (entering positively), 2) married under 18 index (entering positively), 3) still in school index (entering negatively), 4) education index (entering negatively).

To construct each index, we first standardize all variables listed in Table OA.16. We then predict each outcome (ever married, married under 18, still in school, education) by all standardized variables and union fixed effects in the control arm. The individual indices are then:

$$\frac{1}{N}\sum_{i=1}^{N}\frac{\beta_i}{SE_i}var_i, \tag{1}$$

where var_i is the standardized variable, β_i is the coefficient of var_i and SE_i is the clustered standard error of β_i. This gives larger weights to variables that predict the outcomes well and smaller weights to variables that predict the outcome with noise.

The three variables with the highest weights (and their sign) for each index are:

- ever married: can she comfortably discuss harassment with someone (-), ever discussed harassment at school with parents (+), marriage age desired (-)
- marriage under 18: marriage age desired (-), comfortable to discuss education goals with parents (-)
- still in school: highest education desired (+), comfortable to discuss education with parents (+), desired marriage age (+)
- education: highest education desired (+), desired marriage age (+), comfortable to discuss education with parents (+)

Observability of Social Conservatism

Table OA.16: All variables considered: Share of women (unmarried age 10-17 at program start) for which answers to responses to social conservatism questions differ from those of parents and sisters

	Response differs from	
Variable (girls', parents' means):	parents (%) (N=5,100)	sister (%) (N=1,404)
Wives should be less educated than men (63%, 63%)	38.69	35.80
Women should be allowed to study as far as they want (96%, 96%)	8.12	7.31
Desired education $\geq$ secondary school (96%, 92%)	15.59	28.65
Max. acceptable marriage age $>$ 20 (69%, 66%)	38.33	36.53
Desired marriage age $>$ 20 (35%, 29%)	29.63	30.11
Women should be allowed to wear make-up (67%, .)	.	30.38
Women should be allowed to wear what they want (49%, .)	.	36.69
Comfortable to discuss education with parents (87%, .)	.	14.98
Comfortable to discuss puberty with parents (64%, .)	.	36.48
Comfortable to discuss marriage timing with parents (40%, .)	.	31.26
Comfortable to discuss marriage choice with parents (35%, .)	.	28.97
Comfortable to discuss dowry with parents (32%, .)	.	28.34
Comfortable to discuss harassment with parents (37%, .)	.	26.93
Ever discussed harassment with parents (18%, .)	.	20.09
Women shouldn't work outside the home (4%, .)	.	4.91
Women should only work in case of emergency (8%, .)	.	10.70
Stops activities during menstruation (11%, .)	.	14.51
Would tell someone about rape (71%, .)	.	32.72

Notes: The table shows the share of women who report differently than either their parents or their closest sister in age in the baseline subsample or baseline household survey.

Correlates of Social Conservatism

Table OA.17: Marriage and education outcomes, unmarried girls age 10-17 at program start in control communities, by women's social conservatism at baseline

	Ever Married	Married<18	Still in school	Last class passed	Currently Working	Economic DM
High Social Conservatism	0.087	0.117	-0.171	-2.031	-0.041	-0.087
	(0.022)	(0.023)	(0.022)	(0.161)	(0.025)	(0.033)
High Parents' Social Conservatism	0.059	0.081	-0.106	-0.792	0.013	-0.069
	(0.021)	(0.026)	(0.024)	(0.181)	(0.025)	(0.031)
Outcome Mean	0.721	0.404	0.417	11.421	0.314	-0.071
Observations	1,737	1,668	1,733	1,738	1,723	1,341
FE	Union	Union	Union	Union	Union	Union

Notes: The table shows results from weighted OLS regressions, adjusted for baseline characteristics and stratification (see notes to table 2 in the main paper). We also adjust for controls available in the young women's survey only, namely, the girl's bmi and an indicator for whether she was stunted (proxies for baseline health), and household income. Huber-White robust SEs clustered at the community level. "Economic decision-making" is a Kling Mean Effects index of 11 purchase/investment decisions in which the woman could be involved inside the household. The social conservatism indices are formed as described above. "High Social Conservatism" is an indicator that is 1 if the woman had an above median social conservatism at baseline. "High Parents' Social Conservatism" is an indicator that is 1 if the parents of the woman had an above median social conservatism at baseline. "Outcome mean" is the mean for women with low (below median) social conservatism.

Heterogeneity by Social Conservatism

Table OA.18: Child marriage, unmarried girls age 15-17 at program start in the young women's subsample survey, by girl's social conservatism (SC)

	Low SC		High SC	
	Age 15-17 (1)	Age 15 (2)	Age 15-17 (3)	Age 15 (4)
Empowerment	0.039	0.008	0.067	0.127
	(0.038)	(0.065)	(0.047)	(0.075)
Incentive	-0.043	-0.072	-0.008	-0.024
	(0.039)	(0.066)	(0.057)	(0.090)
Incen.*Empow.	0.122	0.107	-0.107	-0.129
	(0.059)	(0.098)	(0.081)	(0.130)
Control Mean	0.331	0.444	0.453	0.523
Observations	1,062	437	675	318
FE	Union	Union	Union	Union

Notes: The table shows results from weighted OLS regressions, adjusted for baseline characteristics and stratification (see notes to table OA.17), with Huber-White robust SEs clustered at the community level in parentheses. "High Social Conservatism" is an indicator that is 1 if the woman has an above median social conservatism.

OA.3 Theory Appendix

OA.3.1 Proof of Corollary 1: There Are No Mixed-Strategy Equilibria in Control Communities

Note that if the same dowry is charged regardless of when a woman enters, then all women prefer to enter later, because they get educational benefit.

So, any mixed-strategy equilibrium would have to involve entering earlier and paying some lower dowry, or entering later and paying some higher dowry (an agent mixes between two strategies if and only if she is indifferent between them).

Because the non-preferred type has a higher marginal gain from getting educated, for any dowries where the preferred type is indifferent between entering at t_1 and t_2, the non-preferred type will strictly prefer the dowry offered for t_2 entrants. So, IF mixed strategies are played, they must only be played by preferred types, with non-preferred types entering at t_2.

But then that means M must believe that t_1 entrants are preferred type for sure.

Suppose Θ_H plays "enter at t_1 with probability $(1-\lambda)$, enter at t_2 with probability λ". Θ_L enters at t_2 for sure. Then beliefs are: $\mu(\Theta_H|t_1) = 1$, $\mu(\Theta_H|t_2) = \frac{\lambda f}{\lambda f+(1-f)}$ (all states are reached with positive probability).

Then D_1, D_2 must satisfy: $\mu(\Theta_H, E_L) - D_1 = \mu(\Theta_H, E_H) - D_2 \Rightarrow D_1 = D_2 - (\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L))$

1. Suppose M competes for women in t_2. What's D_2?

   M's beliefs are $\Pr(\Theta_H|t_2) = \frac{\lambda f}{\lambda f+(1-f)}$, so M's period 2 utility is $\frac{\lambda f}{\lambda f+(1-f)}\mu(\Theta_H, E_H) + \frac{(1-f)}{\lambda f+(1-f)}\mu(\Theta_L, E_H) + D_2$

   Since M compete for women, $D_2 = \omega_M - \Big(\frac{\lambda f}{\lambda f+(1-f)}\mu(\Theta_H, E_H) + \frac{(1-f)}{\lambda f+(1-f)}\mu(\Theta_L, E_H)\Big)$

   Then $D_1 = \omega_M - \Big(\frac{\lambda f}{\lambda f+(1-f)}\mu(\Theta_H, E_H) + \frac{(1-f)}{\lambda f+(1-f)}\mu(\Theta_L, E_H)\Big) - (\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L))$

2. Do these dowries satisfy M's participation constraint?

   What is M's utility in t_1 at this D_1, given that $\mu(\Theta_H|t_1) = 1$?

   $$\mu(\Theta_H, E_L) + \omega_M - \left(\frac{\lambda f}{\lambda f + (1-f)}\mu(\Theta_H, E_H) + \frac{(1-f)}{\lambda f + (1-f)}\mu(\Theta_L, E_H)\right) - (\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L))$$

   This is smaller than his outside option ω_M iff:

   $$\begin{aligned} &\mu(\Theta_H, E_L) - \left(\frac{\lambda f}{\lambda f + (1-f)}\mu(\Theta_H, E_H) + \frac{(1-f)}{\lambda f + (1-f)}\mu(\Theta_L, E_H)\right) \\ &- (\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L)) < 0 \\ \Leftrightarrow &- \frac{(1-f)}{\lambda f + (1-f)}\mu(\Theta_L, E_H) < (\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L)) \\ &+ \frac{\lambda f}{\lambda f + (1-f)}\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L) \end{aligned}$$

Sufficient:

$$0 < (\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L)) + \frac{\lambda f}{\lambda f + (1-f)}\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L)$$

This clearly holds since $\frac{\lambda f}{\lambda f+(1-f)} \leq 1 \; \forall \lambda$, so that:

$$\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L) > 0 \;\&$$
$$\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L) > \left| \frac{\lambda f}{\lambda f + (1-f)}\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L) \right|$$

But that means that M's utility from this in t_1 is less than his outside option ω_M, which violates his participation constraint. As this is true for all λ, there are no mixed-strategy equilibria because either M has to give a t_1 discount he can't afford, or charge an expensive t_2 dowry that women can't afford.

3. Alternatively, M competes for women in t_1, so that $D_1 = \omega_M - \mu(\Theta_H, E_L)$. To maintain H's indifference, it must be that $D_2 = \omega_M - \mu(\Theta_H, E_L) + (\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L))$. But liquidity constraints mean that D_2 is not feasible (this is the condition for separating equilibrium not being feasible).

OA.3.2 Proof of Result 3: Liquidity Constraints Prevent Separating Equilibrium in Treatment Communities

Does easing liquidity constraints for some randomly chosen women, conditional on delaying marriage, enable a screening menu of dowries?

Note that there are now two dimensions of unobserved type: type and treatment. Since untreated Θ_L still cannot afford the higher dowry for entering later (under our original liquidity constraint), it's clear that the treatment does not enable men to induce all Θ_H to enter at t_1 and all Θ_L to enter at t_2.

Does the treatment enable men to achieve semi-separation by charging a $D|t_2$ that induces only treated Θ_L to enter at t_2? $D|t_1$ and $D|t_2$ would have to satisfy:

$$D|t_2 - D|t_1 < C + \mu(\Theta_L, E_H) - \mu(\Theta_L, E_L)$$
$$D|t_2 - D|t_1 > C + \mu(\Theta_H, E_H) - \mu(\Theta_H, E_L)$$

If treated non-preferred types entered at t_2 and everyone else entered at t_1, Bayes' rule dictates that $\Pr(\Theta = H|t_1) = \frac{f}{f+(1-\tau)(1-f)} \equiv f'$, where $f' > f$. Then to satisfy his participation constraint, the minimum dowry M charges is $D|t_1 = \omega_M - (f'\mu(\Theta_H, E_L) + (1-f')\mu(\Theta_L, E_L))$. But:

$$\begin{aligned} D|t_2 &= \omega_M - (f'\mu(\Theta_H, E_L) + (1-f')\mu(\Theta_L, E_L)) + C + \mu(\Theta_H, E_H) - \mu(\Theta_H, E_L) \\ &> \omega_M - 2\mu(\Theta_H, E_L) + \mu(\Theta_H, E_H) + C \\ &> Y + C. \end{aligned}$$

So, the treatment does not make the separating contract feasible–although some women have been enriched, the very fact that this enrichment is random in type means that there is no way to separate treated preferred types from treated non-preferred types, for the same reason separation is not feasible in control communities. A separating contract would have to fully extract C and charge a rent on top of that for those who delay marriage, where this rent is the same as in the analysis for control communities, and therefore unaffordable.

OA.3.3 Proof of Result 4: Equilibria in Treatment Communities

Pooling on t_2 does not Survive the IC Because men compete for women, the transfer given to treated women is not extracted from them. Thus, if all women enter at t_2, the dowry that men charge is the same as the dowry they would charge if they thought all women entered at t_2 in the absence of any treatment. Clearly, this is still a sequential equilibrium. By the same reasoning as in the control section above, the untreated preferred type prefers to deviate at t_1 under the best possible terms than to abide by the equilibrium and enter at t_2. That is, she can make a credible speech to men that she is a preferred type if she enters at t_1. Hence, this sequential equilibrium continues to fail the IC.

Pooling on t_1 Survives the IC We showed that this sequential equilibrium survives the IC in the control setting. It continues to survive the IC in the treatment setting, since the treatment strengthens the treated women's preference to enter at t_2 and doesn't change anything else. Thus, since untreated non-preferred and preferred types would rather deviate to t_1 at the best possible terms in the control, the untreated and treated non-preferred and preferred types would rather deviate to t_1 at the best possible terms in the treatment. Therefore, this is still an equilibrium. However, we will show that the treatment creates a new, semi-separating equilibrium, in which every agent's welfare is higher.

There is a Semi-Separating Equilibrium, and it Pareto Dominates the Pooling Equilibrium There is no separating equilibrium in the control communities because there were only two types of women, non-preferred and preferred type, and the only way for men to generate separation would be to charge a high enough dowry such that non-preferred types prefer to pay the higher dowry and delay marriage (because they get relatively large gains from further education), while preferred types prefer to enter early and pay the smaller dowry (because unobservable type is first-order and they do not have as much value-added from education, relative to non-preferred types). Because we do not observe separation in our setting, we infer that the extra dowry that men would need to charge for women who delay marriage is too much for non-preferred types to afford.

There is no semi-separating equilibrium in the control communities because again, there are only two types of women, and due to single-crossing, only one type (the preferred type) could possibly be mixing. We showed that there is no

lower dowry $D|t_1$ that M can charge that simultaneously keeps preferred types indifferent between entering at t_1 and t_2, and satisfies M's participation constraint.

Without assuming anything different about liquidity constraints, the treatment makes a semi-separating equilibrium possible because it generates a second dimension of type, and in particular, this second dimension is orthogonal to type. Now, we have treated preferred, treated non-preferred, untreated preferred, and untreated non-preferred types, where crucially treatment is not informative about the unobservable type.

Consider the following equilibrium candidate: untreated preferred types enter at t_1, and everyone else enters at t_2.

Then Bayes' rule implies that M have the following beliefs:

$$\Pr(\Theta = H|t_1) = 1$$
$$\Pr(\Theta = H|t_2) = \frac{\tau f}{\tau f + (1-f)} \equiv f'$$

Note that $f' \to_{\tau \to 1} f$. Thus, dowries charged are:

$$D|t_2 = \omega_M - f'\mu(\Theta_H, E_H) - (1-f')\mu(\Theta_L, E_H)$$
$$D|t_1 = \omega_M - \mu(\Theta_H, E_L)$$

Treated preferred types prefer t_2 to t_1 if and only if (Condition 1):

$$\mu(\Theta_H, E_H) - [\omega_M - f'\mu(\Theta_H, E_H) - (1-f')\mu(\Theta_L, E_H)] + C > \mu(\Theta_H, E_L) - [\omega_M - \mu(\Theta_H, E_L)]$$

If treated preferred types prefer t_2 to t_1, then so do treated non-preferred types.

Untreated non-preferred types prefer t_2 to t_1 if and only if (Condition 2):

$$\mu(\Theta_L, E_H) - [\omega_M - f'\mu(\Theta_H, E_H) - (1-f')\mu(\Theta_L, E_H)] > \mu(\Theta_L, E_L) - [\omega_M - \mu(\Theta_H, E_L)]$$

Untreated preferred types prefer t_1 to t_2 if and only if (Condition 3):

$$\mu(\Theta_H, E_L) - [\omega_M - \mu(\Theta_H, E_L)] > \mu(\Theta_H, E_H) - [\omega_M - f'\mu(\Theta_H, E_H) - (1-f')\mu(\Theta_L, E_H)]$$

Condition 3 holds by assumptions (we showed in the control analysis that preferred types prefer t_1 under the belief that t_1 entrant is preferred type for sure over t_2 under the belief that t_2 entrant is preferred type with probability f. Here, the belief that t_2 entrant is preferred type is $f' < f$, so Condition 3 holds as an implication).

Condition 2 is the least likely to hold for $f' = 0$, in which case it holds by the substitutes condition 2.

Condition 1 holds by assumption as long as the transfer is non-trivial.

A key observation is that the treatment's impact is all about the common knowledge that treated preferred types now have a stronger incentive to delay marriage and not at all about women getting richer.

Recall that the dowry charged in the "pooling on t_1" case is $\omega_M - f\mu(\Theta_H, E_L) - (1-f)\mu(\Theta_L, E_L)$. Note that *every* woman is strictly better off in this semi-separating equilibrium, and no man is worse off (since men compete for women, they always get their outside option ω_M in every equilibrium).

Untreated preferred types are strictly better off, because they still enter at t_1 and are uneducated, but pay a strictly lower dowry than they do in the "pooling on t_1" equilibrium, because now men believe they are preferred type for sure. Everyone else is strictly better off because they do even better by entering at t_2 than entering at t_1 and paying that strictly lower dowry. So, even though "pooling on t_1" continues to be a sequential equilibrium that survives the IC, this semi-separating equilibrium is also a sequential equilibrium, and **Pareto dominates**.

OA.3.4 Optimal Coverage of the Incentive

First, we observe that, if it is the case that under treatment coverage τ, every treated woman delays marriage (fixing transfer size), then it is the case that under treatment coverage $T > \tau$, every treated woman delays. This is because increasing treatment coverage increases the beliefs that t_2 entrants are preferred types (since untreated preferred types continue to enter at t_1). Thus, giving every woman the conditional incentive would be likeliest to cause all women to delay marriage.

However, we show that this is not the policy that yields the most benefit for cost, given linear benefits and costs. This is because treating every woman mechanically eliminates the scope for positive spillovers.

We formalize this in the following result. Suppose that delaying marriage for a woman yields unit benefit B_Θ, and that total cost of the treatment is the transfer C multiplied by the number of women receiving the treatment (the monetary cost of the treatment). Suppose that the conditional incentive is given randomly. Then:

Result 1. *(i) Interior treatment coverage maximizes total social welfare when benefits and costs are linear in the number of women treated. (ii) The minimal treatment coverage needed to induce treated preferred types to delay if the size of the transfer is C is:*

$$\tau_{\min}(C) = \frac{\frac{2\mu(\Theta_H,E_L)-[\mu(\Theta_H,E_H)+\mu(\Theta_L,E_H)]-C}{[\mu(\Theta_H,E_H)-\mu(\Theta_L,E_H)]}}{\left[1-\frac{2\mu(\Theta_H,E_L)-[\mu(\Theta_H,E_H)+\mu(\Theta_L,E_H)]-C}{[\mu(\Theta_H,E_H)-\mu(\Theta_L,E_H)]}\right]}\frac{(1-f)}{f}$$

Observe that the more widespread the coverage, the smaller the transfer that is needed.

Thus, if child marriage persists due to signaling motives, the most cost-effective random conditional incentive is one with lower coverage and larger transfers if non-preferred types are believed to be prevalent (to maximize spillovers), while greater coverage and smaller transfers are preferred if non-preferred types are believed to be less prevalent.[1]

Suppose we say there is a social benefit B_H to preferred-type women delaying marriage, and B_L to non-preferred-type women delaying marriage (and 0 if women

[1]Of course, non-preferred types must be a significant presence in the population for there to be a signaling story in the first place.

of either type get married as a child). Then total welfare generated by (coverage, transfer size) is

$$\begin{aligned} & \tau_{\min}(C) f B_H + (1-f) B_L - \tau_{\min}(C) C \\ \frac{\partial}{\partial C} \quad : \quad & \tau'_{\min}(C)[f B_H + C] - \tau_{\min}(C) = 0 \\ \frac{\partial^2}{\partial C^2} \quad : \quad & \tau''_{\min}(C)[f B_H + C] < 0 \end{aligned}$$

So, there is an interior optimal coverage and transfer size—full coverage is not what maximizes total welfare.

If we had estimates for the match utilities depending on the different unobservable desirability and education types ($\mu(\Theta, E)$), as well as the fraction of preferred types f, we could obtain a number for C^*, $\tau(C^*)$.

Next we consider the optimal policy if the treatment is non-random or observable.

1. First observation: if treatment coverage is complete, then observability and randomness are moot. So, suppose treatment coverage is partial.

2. Suppose $\tau < 1$ and treatment is random but fully observable.

   Then, all treated women can delay marriage (depending on size of conditional transfer), but we'd lose the spillovers. The untreated who tried to delay marriage would be known to be non-preferred type (because they have the higher marginal returns to education, under the signaling story and given our observation of mostly pooling on child marriage in the control). We think the parameters are such that husbands do not want to marry known non-preferred types, even if they have education (this must be true if the signaling story underlies pooling on child marriage in the status quo).

   Thus, it could be that our randomized treatment was partially observed in practice, attenuating our spillovers—if it had been totally unobserved, we may have seen even bigger spillovers.

3. If treatment is not random

   (a) Not observable, treated more likely to be Θ_H ($\tau_H > \tau_L$): this strengthens the treatment, in the sense that all treated types delay, but untreated types (both preferred and non-preferred) now have stronger incentive to also delay.

   (b) Not observable, treated more likely to be Θ_L: this dampens all women's incentive to delay.

   (c) Observable, treated more likely to be Θ_H: strengthens treated women's incentives to delay, but dampens untreated women's incentives to delay (spillovers), as treated being more likely to be Θ_H implies that untreated is more likely to be Θ_L, and treatment status is observable.

(d) Observable, treated more likely to be Θ_L: different contracts for treated and untreated at t_2. Treated at t_2 face more expensive dowries, but still delay because they receive the conditional transfer–treatment status is observable no matter when you enter, so you might as well delay and get $+C$ and education. Untreated at t_2 are offered lower dowries, and this may be low enough to cause even untreated preferred types to prefer delay. The key intuition is that men's beliefs about your unobservable type are now more about your treatment status than when you enter. This makes it possible for potentially all women to delay, even though not all women are treated.

This analysis suggests an interesting policy insight, which is that the "best" policy (if it were possible) could be to observably give more non-preferred than preferred type women the conditional transfer (but not only give it to non-preferred type–there has to be some probability treated are preferred type).

We do not think this is feasible, because we do not think researchers have a special ability to observe this unobservable type.

However, if the concern is that people can sometimes observe treatment status and think that treated women are more likely to be non-preferred type, that actually strengthens the treatment effect. Partial observability and non-randomness (as long as observed treatment is not thought to be only given to non-preferred type) could be most effective.

OA.3.5 Proof of Corollary 2: Changing Distribution of Bride Types

From result 2, we know that, if liquidity constraints preclude a separating equilibrium, then pooling on child marriage happens when:

$$\begin{aligned}\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L) < \mu(\Theta_H, E_L) - \mu(\Theta_L, E_H) - f(\mu(\Theta_H, E_H) - \mu(\Theta_L, E_H)) \\ < \mu(\Theta_L, E_H) - \mu(\Theta_L, E_L).\end{aligned}$$

The left-hand side is more likely to hold as f decreases, since $\mu(\Theta_H, E_H) - \mu(\Theta_L, E_H) > 0$. The right-hand side always holds, since it holds for $f = 0$ by condition 2 of our model:

$$\mu(\Theta_H, E_H) - \mu(\Theta_H, E_L) < \mu(\Theta_H, E_L) - \mu(\Theta_L, E_H) < \mu(\Theta_L, E_H) - \mu(\Theta_L, E_L).$$

Hence, pooling on early marriage and low education grows more likely as f decreases.