Online Appendix

The Effects of "Girl-Friendly" Schools: Evidence from the BRIGHT School Construction Program in Burkina Faso

By HAROUNAN KAZIANGA, DAN LEVY, LEIGH L. LINDEN, AND MATT SLOAN

This appendix presents our estimates of the cost effectiveness of the BRIGHT intervention. In Section A, we present our strategy for estimating the costs of both BRIGHT and traditional government public schools. In Section B, we present the cost effectiveness estimates of the BRIGHT program as implemented. In Section C, we present the marginal cost effectiveness of moving from a traditional government school to a BRIGHT school.

A key issue underlying the analyses presented in this memo is that although we have reasonably reliable information on the costs associated with the BRIGHT program, the information on the costs of the government schools is much less reliable. In fact, we obtained two cost estimates of building a typical government school but lack sufficient confidence in the information to favor one estimate over the other. We therefore present our cost effectiveness estimates under two scenarios: one based on the high-cost estimate of the government schools (scenario I) and the other based on the low-cost estimate (scenario II). All cost effectiveness estimates are measured in 2007 U.S. dollars.

A. Estimating the Costs of the Schools

We begin with a detailed estimate of the costs of the various components in the schools. These are presented in Table A14. These estimates were obtained from

the Millennium Challenge Corporation (MCC) and the Burkina Faso Ministry of Education. As explained in the text, we received two estimates of costs from the Ministry, which are presented as scenarios I and II. Panel A contains costs that are estimated to last for the 40-year lifetime of the building. Panel B lists costs that recur on an annual basis, and Panel C contains maintenance costs that need to be spent every five years. It is important to note that for scenario I, we were given a lump sum cost that included many of the amenities that are broken out for the BRIGHT schools and for scenario II. In addition, for scenario II (and for the maintenance costs in scenario I), we were unable to obtain cost estimates for individual amenities. In scenario I, we use the same cost estimates as for the BRIGHT schools. In scenario II, we use the BRIGHT cost estimates reduced by the ratio of the cost of the BRIGHT and government school complex to account for the fact that the government normally spent less than the amounts required by the BRIGHT program.

To calculate the total cost for each panel, we have to take into account that not all schools have each amenity. We thus provide the associated probability that each amenity is present. We can then take the sum of each amenity multiplied by the fraction of schools with the given amenity to calculate the average cost per school for each panel.

To calculate the incremental cost of the BRIGHT intervention, we must take into account that villages on either side of the discontinuity had access to a BRIGHT school, access to government schools, or no access to any school. Table A15 contains the fraction of villages that had the specified type of school for villages just below the cutoff (control) and villages just above the cutoff (treatment). Clearly, the treatment villages overwhelmingly have BRIGHT schools, whereas the control villages have a combination of mostly government schools and no schools.

The ultimate annual costs are then presented in Table A16. We first calculate the estimates for the BRIGHT and government schools for each scenario in the first two rows. To do this, we depreciate the total costs for each panel of Table A14 by the indicated period and add the resulting per-year costs together. We assume a constant rate of depreciation so that, for example, the total fixed cost of a BRIGHT school of $97,911 results in an annual cost of $2,448 when calculated over the estimated 40-year lifespan. The total annual cost ($10,659) is then calculated by adding the total amortized fixed cost to the amortized maintenance costs ($300) and the total of the annual costs ($7,911).

The estimates for the treatment and control villages are based on the estimates for the BRIGHT and government schools. Using the probabilities presented in Table A15, we weight the costs of the government and BRIGHT schools. For example, the annual cost for a treatment village is 0.91 times the cost of a BRIGHT school added to 0.03 times the cost of a government school. Row 5 then contains the difference in cost between a selected and a non-selected village, and row 6 contains the difference between a BRIGHT school and a government school.

Finally, Table A17 contains the estimates of our outcome variables for the villages and the schools. In Panel A, all of the estimates are taken from regressions similar to those presented in Tables 5 and 7. The estimates for the non-selected villages are taken from regressions similar to those in column 2, but without the department-level fixed effects, so that the estimate of the coefficient on the constant term is then an estimate of the average for villages directly to the left of the discontinuity. The estimate for the selected villages is then the estimate for the non-selected villages plus our estimate of the treatment effect from our preferred specification in column 1 of Tables 5 and 7. The estimates in Panel B are similar to those in Panel A, but they are taken from columns 1, 2, 4, and 5 of Table 8 instead.

B. Cost Effectiveness of the BRIGHT Program as Implemented

Table A18 presents the key information used to calculate the cost effectiveness of the BRIGHT program as implemented. The costs presented in the table are on a per-year basis (enrollment figures) or per-2.5-year basis (test scores figures) because the choice to enroll is an annual decision made by parents, whereas the children's test scores reflect learning that occurred in the first 2.5 years of the BRIGHT program. The difference in outcomes presented are based on the impacts estimated using the regression discontinuity design presented in Table A17.

To estimate the cost effectiveness of BRIGHT, we first estimated the costs associated with providing the program in the villages close to the eligibility cutoff and then divided this amount by the impact estimates (which are based on this same set of villages). In the case of enrollment, we divided the costs of BRIGHT over one year by the impact on the number of enrolled children. In the case of test scores, we divided the *per child* costs over 2.5 years by the impact in test scores measured in 0.1 of a standard deviation.

The cost effectiveness of BRIGHT at increasing enrollment is $61.82 per student per year under scenario I and $70.22 per student per year under scenario II (Table A18). The cost of improving test scores is $6.99 per student per 0.1 of a standard deviation over the 2.5 years of the intervention under scenario I and $7.94 per student per 0.1 of a standard deviation under scenario II.

C. Marginal Cost Effectiveness of Moving from a Government School to a BRIGHT School

Although the estimates presented in Section B measure the cost effectiveness of BRIGHT relative to what would have happened in the absence of the program (that is, the counterfactual), they are not directly comparable to other interventions that have been recently evaluated and for which we have cost

effectiveness information. Almost all these other education interventions are add-on programs for existing schools. Because BRIGHT involves building schools, it is reasonable to expect that the cost of BRIGHT will be much higher than the cost of interventions that take advantage of existing schools. Moreover, the comparison is problematic because those other interventions can only be implemented in places where a school already exists; therefore, they would not be viable interventions for the large number of villages that would not have a school in the absence of BRIGHT. In this section, we present the cost effectiveness estimates of building a BRIGHT school in a village where a government school is already planned. Because the government school is already planned, it makes sense to compare the marginal benefits of investing more in infrastructure to produce a BRIGHT school versus investing the additional funds in some of the other add-on programs that have been evaluated in the literature.

The key advantage of these marginal cost effectiveness estimates over the ones presented in the previous section is that they are more comparable to cost effectiveness estimates of other interventions in the literature. The key disadvantage is that they rely on impact estimates that are less reliable than the ones used in Section V because they depend on the results presented in Section VI, which require additional assumptions.

To construct this estimate, we divided the difference in cost between a BRIGHT school and a government school by the impacts in enrollment and test scores that are due to a higher quality school (that is, the estimated impacts of BRIGHT relative to a government school). It is important to note that whereas the previous estimate is an average cost effectiveness calculation, this one is a marginal cost effectiveness calculation because it compares the change in costs to the change in benefits from the program.

The marginal cost effectiveness of the increase in enrollment is $42.87 per student per year under scenario I and $63.12 under scenario II. The marginal cost

effectiveness of the change in test scores is $4.26 per student per 0.1 of a standard deviation over two years under scenario I and $6.27 under scenario II (Table A19).

To get a broad sense of the magnitude of these cost effectiveness estimates, we compared them to cost effectiveness estimates of other education interventions in the literature. The BRIGHT cost effectiveness estimates are in the midrange for both enrollment and for test scores (Tables A20 and A21). It is important to note that most of these other interventions were also add-ons evaluated in traditional government schools and are thus viable comparisons to the marginal cost effectiveness of the BRIGHT schools.

Nevertheless, these comparisons require caution for a number of reasons. First, because some interventions may affect multiple outcomes, such as health and schooling (as in the deworming intervention), the overall effectiveness of such programs will be understated when calculating a cost effectiveness estimate for schooling alone. Second, costs of similar interventions could vary across countries. Third, different measures of enrollment were used in different research papers. Fourth, the impacts of BRIGHT on test scores are driven partly by the additional enrollment produced by the program, whereas in many of the other interventions, the impact is based on students already enrolled in school. Finally, some of these programs involve transfers, in which case some of the real cost for the social planner is the cost of raising funds, that is, the deadweight loss associated with raising funds (see Kremer et al. 2009). To the extent that the cost of raising funds differs by country, cost effectiveness comparisons need to be exercised with caution.

REFERENCES

Angrist, Joshua, Eric Bettinger, Erik Bloom, Elizabeth King, and Michael Kremer. 2002. "Vouchers for Private Schooling in Colombia: Evidence from a Randomized Natural Experiment." *The American Economic Review* 92 (5): 1535–1558.

Banerjee, Abhijit, Shawn Cole, Esther Duflo, and Leigh L. Linden. 2007 "Remedying Education: Evidence from Two Randomized Experiments in India." *Quarterly Journal of Economics* 122(3): 1235-1264

Bobonis, Gustavo J., Edward Miguel, and Charu Puri-Sharma. 2006. "Anemia and School Participation." *Journal of Human Resources* 41(4):692-721.

Burde, Dana, and Leigh L. Linden. 2011. "The Effects of Village-Based Schools: Evidence from a Randomized Controlled Trial in Afghanistan." *American Economic Journal: Applied Economics.*

Chin, Aimee. 2005. "Can Redistributing Teachers Across Schools Raise Educational Attainment? Evidence from Operation Blackboard in India." *Journal of Development Economics* 78(2): 384-405.

Duflo, Esther. 2001. "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment." *American Economic Review* 91 (4): 795–813.

Duflo, Esther, Pascaline DuPas, and Michael Kremer. 2007. *Peer Effects, Pupil-Teacher Ratios, and Teacher Incentives.* Hanover, NH: Dartmouth College, Department of Economics.

Duflo, Esther, Pascaline Dupas, and Michael Kremer. 2008. "Peer Effects, Pupil-Teacher Ratios, and Teacher Incentives: Evidence from a Randomized Evaluation in Kenya." NBER Working Paper No. 14475.

Duflo, Esther, Rema Hanna, and Stephen Ryan. 2012. "Incentives Work: Getting Teachers to Come to School." *American Economic Review* 102(4): 1241-1278.

Evans, David K., and Arkadipta Ghosh. 2008. "Prioritizing Educational Investments in Children in the Developing World." RAND Labor and Population Working Paper No. WR-587.

Evans, David, Michael Kremer, and Muthoni Ngatia. 2008. "The Impact of Distributing School Uniforms on Children's Education in Kenya." Unpublished.

Glewwe, Paul, Michael Kremer, and Sylvie Moulin. 2003. *Textbooks and Test Scores: Evidence from a Prospective Evaluation in Kenya.* Cambridge, MA: Harvard University, Department of Economics.

Glewwe, Paul, Ilias Nauman, and Michael Kremer. 2003. "Teacher Incentives." National Bureau of Economic Research Working Paper no. 9671.

Glewwe, Paul, Michael Kremer, Sylvie Moulin, and Eric Zitzewitz. 2004. "Retrospective vs. Prospective Analyses of School Inputs: The Case of Flip Charts in Kenya." *Journal of Development Economics* 74 (1): 251–268.

He, Fang, Leigh L. Linden, and Margaret MacLeod. 2008. "Testing the Relative Productivity of Instruction Methods within the Pratham English Language Education Program." http://leighlinden.com/Research.html

Kremer, Michael, and Christel Vermeersch. 2005. "School Meals, Educational Achievement and School Competition: Evidence from a Randomized Evaluation." World Bank Working Paper No. 3523.

Kremer, Michael, and Edward Miguel. 2004. "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities." *Econometrica* 72(1): 159-217.

Kremer, Michael, Edward Miguel, and Rebecca Thornton. 2009. "Incentives to Learn." *The Review of Economics and Statistics* 91(3): 437-456.

Kremer, Michael, Sylvie Moulin, and Robert Namuynu. 2003. "Decentralization" A Cautionary Tale." Poverty Action Lab Working Paper No. 10.

TABLE A1—SUMMARY OF VILLAGE CHARACTERISTICS

	Overall average	Non-marginal villages	Marginal villages	Difference
	(1)	(2)	(3)	(4)
Panel A: Household				
Head is male	0.982	0.982	0.983	0.001
	(0.132)	(0.133)	(0.130)	(0.005)
Age of head	48.058	48.493	47.095	-1.398
	(12.425)	(12.728)	(11.668)	(0.493)
Head's years of school	0.159	0.177	0.119	-0.058
	(0.929)	(0.998)	(0.754)	(0.036)
Language: Moore	0.392	0.454	0.255	-0.199
	(0.488)	(0.498)	(0.436)	(0.051)
Ethnicity: Mossi	0.4	0.46	0.266	-0.195
	(0.490)	(0.498)	(0.442)	(0.051)
Basic floor material	0.931	0.922	0.952	0.031
	(0.253)	(0.269)	(0.214)	(0.016)
Basic roof material	0.552	0.519	0.625	0.106
	(0.497)	(0.500)	(0.484)	(0.049)
Number of radios	0.752	0.785	0.679	-0.106
	(0.808)	(0.847)	(0.708)	(0.043)
Number of phones	0.187	0.208	0.141	-0.067
	(0.480)	(0.515)	(0.387)	(0.024)
Number of watches	0.819	0.852	0.746	-0.106
	(0.944)	(0.984)	(0.844)	(0.050)
Number of bikes	1.473	1.552	1.3	-0.252
	(1.267)	(1.319)	(1.124)	(0.090)
Number of cows	5.665	5.325	6.416	1.091
	(10.087)	(9.911)	(10.429)	(0.630)
Religion Muslim	0.583	0.573	0.605	0.032
	(0.493)	(0.495)	(0.489)	(0.047)
Panel B: Children				
Age	8.765	8.754	8.789	0.035
	(1.970)	(1.971)	(1.966)	(0.048)
Male	0.466	0.471	0.455	-0.016
	(0.499)	(0.499)	(0.498)	(0.009)
Head's child	0.884	0.88	0.891	0.011
	(0.320)	(0.324)	(0.311)	(0.015)

Notes: This table presents the household- and child-level characteristics for children in the sample. Columns 1, 2, and 3 present the average and standard deviation of the characteristics for the full sample, the sample with an assigned score between -40 and 40, and the sample with a score below -40 or above 40. Finally, column 4 presents the estimated average difference between columns 2 and 3, along with the standard deviation of the difference in parentheses.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level

TABLE A2—EFFECTS OF BRIGHT SCHOOLS ON EXISTENCE OF A SCHOOL

	(1)	(2)	(3)	(4)	(5)	(6)
Selected for BRIGHT (Relative Score ≥ 0)	0.315***	0.320***	0.320***	0.291***	0.217	0.224***
	(0.057)	(0.051)	(0.057)	(0.068)	(0.171)	(0.082)
Relative Score	1.271	1.057	0.966	4.301	3.275**	
	(1.267)	(0.758)	(1.354)	(6.422)	(1.390)	
Relative Score^2	-0.935		9.565	71.701	52.724***	
	(4.423)		(16.910)	(92.646)	(15.096)	
Relative Score^3				-2.074		
				(7.067)		
Relative Score * Selected			-26.412			
			(41.053)			
Relative Score^2 *Selected				-75.458		
				(92.563)		
Constant	0.542***	0.539***	0.539***	0.557***		0.388
	(0.121)	(0.120)	(0.121)	(0.126)		(0.274)
Observations	287	287	287	287	222	93
R^2	0.34	0.339	0.341	0.343		0.303
Prob > F	< 0.001	< 0.001	< 0.001	< 0.001		0.341
Prob > Chi^2					< 0.001	
Department fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Model	Quadratic	Linear	Cubic	Interacted quadratic	Quadratic probit	|Rel. Score| < 40

Notes: This table presents estimates of the estimated discontinuity in the relationship between being selected for the BRIGHT program and the existence of any school in a village at the time of the follow-up survey using the indicated specification for Equation (1). Relative Score is measured in units of 10,000 points because of the small magnitude of the coefficients. Column 5 omits departments in which all villages received a school. Although the estimates in columns 5 and 6 are still consistent with the existence of a large discontinuity, we have also estimated the OLS specification with polynomials of degree 0 through 8 to ensure that the difference in the magnitudes is not due to a lack of flexibility in the specification in columns 1-3. For all specification, we find similar estimates to those in columns 1-3.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level

TABLE A3—EFFECTS OF BRIGHT SCHOOLS ON VERIFIED ENROLLMENT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Selected for BRIGHT (Relative Score ≥ 0)	0.154***	0.158***	0.169***	0.156***	0.134***	0.175***	0.138***
	(0.027)	(0.028)	(0.024)	(0.027)	(0.034)	(0.030)	(0.036)
Relative Score	0.81	1.008	0.251	0.712	4.271	0.891	
	(0.682)	(0.682)	(0.396)	(0.688)	(3.265)	(0.746)	
Relative Score^2	-2.518	-3.058*		0.605	43.777	-2.824	
	(1.787)	(1.793)		(8.780)	(42.795)	(1.933)	
Relative Score^3				-7.801			
				(21.363)			
Relative Score * Selected					-3.839		
					(3.596)		
Relative Score^2 * Selected					-45.41		
					(42.720)		
Constant	0.139	0.418***	0.131	0.135	0.158		-0.002
	(0.126)	(0.106)	(0.125)	(0.126)	(0.128)		(0.020)
Observations	17,970	17,970	17,970	17,970	17,970	17,970	5,595
R^2	0.167	0.121	0.166	0.167	0.167		0.113
Prob > F	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001
Prob > Chi^2						< 0.001	
Demographic controls	Yes	No	Yes	Yes	Yes	Yes	No
Department fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No
Model	Quadratic	Quadratic	Linear	Cubic	Interacted quadratic	Quadratic probit	|Rel Score| < 40

Notes: This table presents estimates of the estimated discontinuity in the relationship between being selected for the BRIGHT program and whether or not a child was observed in class during the survey of the child's school using the indicated specification for Equation (1). Relative Score is measured in units of 10,000 points because of the small magnitude of the coefficients.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

TABLE A4—EFFECTS OF BRIGHT SCHOOLS ON CHILDREN'S ACTIVITIES

	Collecting firewood	Cleaning	Fetching water	Caring for siblings	Tending animals	Help farming	Help shopping
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: All Children							
Selected for BRIGHT	-0.071***	-0.044*	-0.041**	-0.052**	-0.058***	-0.026**	-0.01
(Relative Score ≥ 0)	(0.023)	(0.022)	(0.020)	(0.024)	(0.021)	(0.013)	(0.025)
Relative Score	-0.467	0.158	-0.385	-0.251	-0.838*	0.298	0.038
	(0.480)	(0.374)	(0.443)	(0.378)	(0.427)	(0.210)	(0.423)
Relative Score^2	1.759	0.345	1.507	1.222	2.287**	-0.819	0.654
	(1.208)	(1.008)	(1.174)	(1.029)	(1.149)	(0.567)	(1.177)
Constant	0.450***	0.106	0.536***	0.461***	0.350***	0.262**	0.139
	(0.133)	(0.111)	(0.094)	(0.126)	(0.106)	(0.117)	(0.112)
Observations	17,911	17,919	17,920	17,922	17,922	17,923	17,923
R^2	0.166	0.207	0.178	0.183	0.151	0.171	0.263
Prob > F	0	0	0	0	0	0	0
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: By Gender							
Selected for BRIGHT	-0.067***	-0.039	-0.044*	-0.050*	-0.065***	-0.029**	0.004
(Relative Score ≥ 0)	(0.024)	(0.024)	(0.024)	(0.026)	(0.023)	(0.015)	(0.026)
Selected * Female	-0.007	-0.01	0.008	-0.003	0.016	0.007	-0.030**
	(0.020)	(0.026)	(0.022)	(0.021)	(0.023)	(0.012)	(0.013)
Relative Score	-0.466	0.16	-0.386	-0.25	-0.841*	0.297	0.043
	(0.480)	(0.374)	(0.443)	(0.378)	(0.428)	(0.210)	(0.423)
Relative Score^2	1.756	0.34	1.511	1.221	2.295**	-0.816	0.639
	(1.209)	(1.008)	(1.174)	(1.028)	(1.149)	(0.567)	(1.178)
Constant	0.448***	0.104	0.538***	0.460***	0.354***	0.264**	0.131
	(0.134)	(0.111)	(0.094)	(0.126)	(0.106)	(0.118)	(0.112)
Observations	17,911	17,919	17,920	17,922	17,922	17,923	17,923
R^2	0.166	0.207	0.178	0.183	0.151	0.171	0.263
Prob > F	0	0	0	0	0	0	0
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents estimates of the discontinuity in the relationship between the probability that a child engages in the indicated activity and the child's village being selected for the BRIGHT program using Equation (1) with all control variables and a quadratic specification for the Relative Score variable. Panel A provides the aggregate treatment effects, and Panel B provides the estimates disaggregated by gender. Relative Score is measured in units of 10,000 points because of the small magnitude of the coefficients.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

TABLE A5—EFFECTS OF BRIGHT SCHOOLS ON MATH TEST SCORES

	(1)	(2)	(3)	(4)	(5)	(6)
Selected for BRIGHT (Relative Score ≥ 0)	0.406***	0.401***	0.439***	0.415***	0.423***	0.349***
	(0.051)	(0.052)	(0.049)	(0.051)	(0.062)	(0.062)
Relative Score	1.600**	1.887**	0.296	1.066	-2.173	
	(0.791)	(0.824)	(0.706)	(0.913)	(5.935)	
Relative Score^2	-5.877***	-6.425***		11.168	-27.465	
	(2.206)	(2.306)		(10.658)	(70.086)	
Relative Score^3				-42.566*		
				(24.106)		
Relative Score * Selected					5.279	
					(6.588)	
Relative Score^2 * Selected					17.55	
					(69.446)	
Constant	-0.064	0.05	-0.083	-0.084	-0.097	-0.823***
	(0.228)	(0.160)	(0.226)	(0.228)	(0.229)	(0.085)
Observations	17,970	17,970	17,970	17,970	17,970	5,595
R^2	0.121	0.11	0.121	0.122	0.122	0.1
Prob > F	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Demographic controls	Yes	No	Yes	Yes	Yes	Yes
Department fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Model	Quadratic	Quadratic	Linear	Cubic	Interacted quadratic	|Rel. Score| < 40

Notes: This table presents estimates of the discontinuity in the relationship between being selected for the BRIGHT program and the child's total math score using the indicated specification for Equation (1). Relative Score is measured in units of 10,000 points because of the small magnitude of the coefficients.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

TABLE A6—EFFECTS OF BRIGHT SCHOOLS ON FRENCH TEST SCORES

	(1)	(2)	(3)	(4)	(5)	(6)
Selected for BRIGHT (Relative Score ≥ 0)	0.373***	0.368***	0.407***	0.382***	0.382***	0.291***
	(0.047)	(0.049)	(0.045)	(0.046)	(0.055)	(0.056)
Relative Score	1.527*	1.833**	0.202	1.021	-1.089	
	(0.845)	(0.860)	(0.665)	(0.854)	(5.277)	
Relative Score^2	-5.968***	-6.475***		10.188	-4.277	
	(2.298)	(2.341)		(12.141)	(64.160)	
Relative Score^3				-40.346		
				(29.943)		
Relative Score * Selected					4.291	
					(5.933)	
Relative Score^2 * Selected					-6.262	
					(63.765)	
Constant	-0.16	0.031	-0.18	-0.18	-0.191	-0.774***
	(0.249)	(0.200)	(0.248)	(0.249)	(0.247)	(0.104)
Observations	17,970	17,970	17,970	17,970	17,970	5,595
R^2	0.109	0.098	0.109	0.11	0.11	0.099
Prob > F	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Demographic controls	Yes	No	Yes	Yes	Yes	Yes
Department fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Model	Quadratic	Quadratic	Linear	Cubic	Interacted quadratic	|Rel. Score| < 40

Notes: This table presents estimates of the discontinuity in the relationship between being selected for the BRIGHT program and the child's total French score using the indicated specification for Equation (1). Relative Score is measured in units of 10,000 points due to the small magnitude of the coefficients.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

TABLE A7—ESTIMATED EFFECTS BY COMPETENCY, MATH SECTION

	Number identification (1)	Counting (2)	Greater than less than (3)	Single digit addition (4)	Single digit subtraction (5)
Average raw score	0.218	0.185	0.155	0.143	0.124
Unselected sample	(0.395)	(0.377)	(0.355)	(0.343)	(0.317)
Raw score	0.203***	0.168***	0.146***	0.131***	0.109***
	(0.023)	(0.021)	(0.019)	(0.019)	(0.018)
Normalized score	0.455***	0.392***	0.357***	0.331***	0.295***
	(0.051)	(0.049)	(0.047)	(0.047)	(0.049)

Notes: This table presents estimates of the treatment effects for test scores disaggregated by type of question. The first row provides the mean fraction of correct answers and the standard deviation for children in the villages not selected for the BRIGHT program. The second row provides the estimated treatment effect in terms of the fraction of correct answers, and the last column provides the estimated treatment effects for the normalized score for each set of questions. All effects are estimated using Equation (1) with full set of controls and a quadratic specification.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

TABLE A8—ESTIMATED EFFECTS BY COMPETENCY, FRENCH SECTION

	Letter identification (6)	Read easy words (7)	Read hard words (8)	Fill in missing word (9)
Average raw score	0.19	0.141	0.104	0.045
Unselected sample	(0.381)	(0.337)	(0.296)	(0.196)
Raw score	0.177***	0.136***	0.100***	0.045***
	(0.021)	(0.018)	(0.016)	(0.010)
Normalized score	0.408***	0.347***	0.286***	0.191***
	(0.049)	(0.047)	(0.046)	(0.044)

Notes: This table presents estimates of the treatment effects for test scores disaggregated by type of question. The first row provides the mean fraction of correct answers and the standard deviation for children in the villages not selected for the BRIGHT program. The second row provides the estimated treatment effect in terms of the fraction of correct answers, and the last column provides the estimated treatment effects for the normalized score for each set of questions. All effects are estimated using Equation (1) with full set of controls and a quadratic specification.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

TABLE A9—EFFECTS ON ENROLLMENT AND TOTAL TEST SCORES BY AGE

	Child's age						
	6	7	8	9	10	11	12
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Reported enrollment	0.153***	0.198***	0.214***	0.234***	0.197***	0.154***	0.119***
	(0.031)	(0.041)	(0.038)	(0.035)	(0.036)	(0.045)	(0.031)
Total test Scores, ITT	0.190***	0.377***	0.454***	0.607***	0.509***	0.349***	0.264***
	(0.037)	(0.063)	(0.077)	(0.083)	(0.090)	(0.107)	(0.087)
Total test scores, TOT	1.242***	1.905***	2.128***	2.594***	2.587***	2.261***	2.230***
	(0.249)	(0.367)	(0.294)	(0.249)	(0.259)	(0.403)	(0.399)

Notes: This table presents estimated treatment effects disaggregated by age. The first row provides estimates of the effects on self-reported enrollment. The second provides estimates on the normalized total test scores, and the final row provides the estimated effects of attending school. Estimates in rows 1 and 2 are made using Equation (1) with a full set of controls and a quadratic specification. Estimates in the final row are made using the treatment on the treated variant of Equation (1) with enrollment instrumented by whether or not a village was selected for the BRIGHT program.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

TABLE A10—AVERAGE DIFFERENCE BETWEEN SELECTED AND NON-SELECTED VILLAGES

	BRIGHT school	Any school	Reported enrollment	Verified enrollment	Total score
	(1)	(2)	(3)	(4)	(5)
Selected for BRIGHT (Relative Score ≥ 0)	0.896***	0.354***	0.217***	0.177***	0.459***
	(0.026)	(0.040)	(0.021)	(0.022)	(0.041)
Constant	0.049**	0.498***	0.085	0.127	-0.567**
	(0.021)	(0.127)	(0.120)	(0.124)	(0.231)
Observations	17,970	17,970	17,970	17,970	17,970
R^2	0.818	0.34	0.184	0.166	0.186
Prob > F	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Demographic controls	Yes	Yes	Yes	Yes	Yes
Department fixed effects	Yes	Yes	Yes	Yes	Yes
Model	OLS	OLS	OLS	OLS	OLS

Notes: This table presents estimates of the average difference in outcomes between children in villages selected for the BRIGHT program and those not selected. All estimates are performed using Equation (1) with a full set of controls but omitting the Relative Score variables.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

TABLE A11—COMPARISON BY VILLAGE SCHOOL STATUS

Household characteristics	Non-BRIGHT school-no school	BRIGHT school-non-BRIGHT	BRIGHT school-no school	Household assets/ child characteristics	Non-BRIGHT school-no school	BRIGHT school-non-BRIGHT	BRIGHT school-no school
Number of members	-0.313	0.183	-0.145	Basic flooring	-0.003	-0.021	-0.023
	(0.495)	(0.393)	(0.500)		(0.019)	(0.018)	(0.019)
Number of children	0.086	0.277	0.345	Basic roof	0.04	-0.049	-0.009
	(0.252)	(0.215)	(0.272)		(0.060)	(0.051)	(0.059)
Head is male	-0.009	0.006	-0.003	Number of radios	0	0.013	0.011
	(0.006)	(0.006)	(0.005)		(0.062)	(0.051)	(0.062)
Head's age	-0.392	-0.825	-1.257*	Number of phones	0.065**	-0.016	0.049*
	(0.694)	(0.584)	(0.684)		(0.030)	(0.031)	(0.028)
Head's years of schooling	0.035	0.056	0.090**	Number of watches	0.056	-0.042	0.016
	(0.039)	(0.043)	(0.042)		(0.069)	(0.054)	(0.069)
Religion: Muslim	0.042	-0.033	0.017	Number of bikes	-0.066	0.006	-0.068
	(0.055)	(0.047)	(0.054)		(0.107)	(0.098)	(0.115)
Religion: Animist	-0.042	0.022	-0.026	Number of cows	0.03	0.048	0.012
	(0.047)	(0.040)	(0.047)		(0.746)	(0.559)	(0.775)
Religion: Christian	-0.003	0.014	0.008	Number of motorbikes	0.03	0.019	0.046
	(0.031)	(0.027)	(0.032)		(0.033)	(0.029)	(0.032)
Language: Fulfude	0.036	0.024	0.056	Number of carts	-0.014	-0.028	-0.044
	(0.045)	(0.043)	(0.046)		(0.058)	(0.049)	(0.059)
Language: Gulmachema	-0.019	-0.019	-0.043	Child's age	-0.121**	0.053	-0.08
	(0.068)	(0.056)	(0.066)		(0.059)	(0.050)	(0.055)
Language: Moore	-0.003	-0.014	-0.013	Child is male	0.024*	0.011	0.036***
	(0.070)	(0.057)	(0.069)		(0.014)	(0.009)	(0.013)
Ethnicity: Gourmanche	-0.015	-0.014	-0.034	Head's child	-0.022	-0.012	-0.032*
	(0.068)	(0.057)	(0.067)		(0.018)	(0.017)	(0.018)
Ethnicity: Mossi	-0.004	-0.025	-0.024	Head's grandchild	0.016	-0.012	0.003
	(0.070)	(0.057)	(0.069)		(0.013)	(0.010)	(0.011)
Ethnicity: Peul	0.023	0.026	0.046	Head's niece/ nephew	-0.001	0.011*	0.01
	(0.044)	(0.041)	(0.045)		(0.006)	(0.006)	(0.007)

Notes: This table compares the average characteristics of children from villages based on the type of school present in the village. The first column presents the average characteristics for children living in villages with no school. The second column presents the difference in average characteristics for children living in villages with non-BRIGHT schools versus those living in village with no schools. The third column then presents the relative difference in characteristics between children living in villages with BRIGHT schools and those living in villages with non-BRIGHT schools. The final column provides the difference for villages with BRIGHT schools and those with no school.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

TABLE A12—RELATIVE EFFECT OF SCHOOL IMPROVEMENT VERSUS SCHOOL ACCESS

	Math score			French score			All villages by gender	
	All villages	All villages	Had school in 2004	All villages	All villages	Had school in 2004	Enrollment	Total score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BRIGHT school	0.357***	0.355***	0.356***	0.300***	0.301***	0.391***	0.095***	0.329***
	(0.043)	(0.044)	(0.055)	(0.041)	(0.043)	(0.058)	(0.022)	(0.047)
Any school	0.279***	0.282***		0.311***	0.313***		0.258***	0.311***
	(0.069)	(0.070)		(0.055)	(0.056)		(0.032)	(0.067)
BRIGHT school * Female							0.066***	0.036
							(0.020)	(0.040)
Any school * Female							0.019	0.029
							(0.022)	(0.044)
Constant	-0.193	-0.116	1.347***	-0.303	-0.145	1.598***	-0.004	-0.670***
	(0.215)	(0.132)	(0.362)	(0.233)	(0.172)	(0.368)	(0.103)	(0.218)
Observations	17,970	17,970	1,568	17,970	17,970	1,568	17,970	17,970
R^2	0.13	0.118	0.22	0.119	0.107	0.229	0.217	0.197
Demographic controls	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents estimates of the relative effects of a BRIGHT school relative to a traditional school for the indicated outcomes. Columns 1, 2, 4, and 5 present the results of an OLS regression, including the indicated controls. Columns 3 and 6 present estimates of the discontinuity using only the sample of children whose villages already had schools in 2004, before the BRIGHT program was started. Columns 7 and 8 provide estimates of the treatment effects presented in columns 2 and 5 disaggregated by gender.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

TABLE A13—SCORING SURVEY FOR ASSIGNMENT OF VILLAGES TO BRIGHT PROGRAM

Question (score)
1. Number of 7-year-old girls in your village. (+1 pt per girl)
2. Number of girls between 7 and 12 years old in your village. (+1 pt per girl)
3. Number of girls between 7 and 12 years old in your village that are in school. (+1 pt per girl)
4. Distance to travel to the nearest school. (+1 if between 0 and 5km, -1 if > 6km)
5. Number of students at the nearest school. (+1 pt per student)
6. Number of classrooms at the nearest school. (+1 if no rooms, -1 if rooms exist)
7. Number of villages within 3km radius (+1 if between 0 and 5 km, -1 if > 6km)
8. Number of schools for all nearby villages in question 7 (-1 for each school, +1 if none exist)
9. Distance to the closest schools in villages listed in question 7 (for each village: +1 if between 0 and 5 km, -1 if > 6km)
10. Number of girls between 7 and 12 years old in the villages in question 7 (+1 pt per girl)
11. Distance from your village to a high school (+1 if between 0 and 20km, -1 if > 20km)
12. Number of students at the high school (+1 per student)
13. Name of town where the high school is located (Not scored)
14. What is your plan for assuring that all girls will be in school? (+1 pt for each action or plan)
15. What is your plan for helping with the unskilled labor needed to build the school? (+1 pt for each action or plan)
16. What is your plan for teaching the students' parents to read and write? (+1 pt for each action or plan)
17. How do you propose to participate in the management of the school? (+1 pt for each action or plan)

Note: This table contains the individual questions that make up the scoring formula for determining the selection of a village into the BRIGHT program.

TABLE A14—COST ASSOCIATED WITH EACH TYPE OF SCHOOL

	BRIGHT		Government schools		
	Cost ($US)	Percentage of schools with amenity	Scenario I	Scenario II	Percentage of schools with amenity
A. Fixed costs over school life (40 years)					
School complex[1]	$83,366	1	$67,391[2]	$26,087	1
Playground	$138	1	$0	$59[3]	1
Construction supervision	$1,087	1	$0	$467[3]	1
M & E coordination	$1,087	1	$0	$467[3]	1
Water supply	$9,034	0.694	$0	$0[4]	0.17
Daycare	$7,744	0.061	$0	$3330[3]	0.021
Toilets	$3,790	0.776	$0	$1630[3]	0.213
Separate toilets (for boys and girls)	$3,790	0.673	$0	$1,630[3]	0.149
Total fixed costs	*$97,911*		*$67,391*	*$27,740*	
B. Annual costs (1 year)					
Take-home ration	$1,435	0.388	$1,435	$1,435	0.149
Teacher salary	$7,354[5]	1	$5,999[5]	$5,999[5]	1
Total annual costs	*$7,911*		*$6,213*	*$6,213*	
C. Other costs (5 years)					
Maintenance	$1,500	1	$1,500[6]	$645[3]	1
Total other costs	*$1,500*		*$1,500*	*$645*	

Note: Cost estimates for BRIGHT schools were obtained from the MCC directly, whereas cost estimates for the government schools were obtained from the Ministry of Education. The fraction of schools with each amenity is calculated by based on the average characteristics of the BRIGHT and non-BRIGHT schools within 40 points of the discontinuity.

[1]School complex includes a school building comprising three classrooms and teachers' houses.

[2]School complex costs for scenario I include the cost of the classrooms, teachers' houses, well, and other fixed costs.

[3]We were unable to find cost estimates for these amenities. Costs are estimated by taking the costs for the BRIGHT schools and reducing them in proportion to the relative cost of a BRIGHT and government school building with three classrooms. The resulting calculation is to estimate the costs of these amenities at 43 percent of the cost of the same amenity for a BRIGHT school.

[4]Schools under this scenario did not include the construction of a well.

[5]Teacher salary is estimated by multiplying our estimate for the annual salary of a teacher ($3,045) by the number of teachers in each type of school. This is 2.415 for the BRIGHT schools and 1.97 for the government schools.

[6]We were unable to obtain estimates of this cost. Given that this is the higher cost scenario, we include the cost at the same rate as for the BRIGHT schools.

TABLE A15—FRACTION OF VILLAGES WITH SCHOOLS

School type	Non-selected villages	Selected villages
BRIGHT	0.037	0.911
Government	0.586	0.030
None	0.377	0.059

Notes: The fraction of villages with BRIGHT schools is based on the coefficients of a regression similar to that presented in column 1 of Table 1 but without department fixed effects. The estimates of the fraction of villages with government schools are calculated using the estimates from a regression similar to the one presented in column 1 of Table 2 without department fixed effects.

TABLE A16—ANNUAL COSTS

	Scenario I	Scenario II
BRIGHT school	$10,659	$10,659
Government school	$8,198	$7,035
Selected village at discontinuity	$9,955.97	$9,921.10
Non-selected village at discontinuity	$5,198.19	$4,517.07
Selected less non-selected	$4,758	$5,404
Additional cost of BRIGHT school	$2,461	$3,623

Notes: All estimates are calculated by amortizing the costs from Table A14 over the specified time period using straight-line depreciation. The cost of placing a school in a selected village is determined by using the ratio of schools for villages that are just over the cutoff point for receiving a BRIGHT school listed in Table A15. The cost of placing a school in a non-selected village is determined by using the ratio of schools for villages that are just under the cutoff point for receiving a BRIGHT school listed in Table A15. The marginal cost of turning a planned (but not constructed) government school into a BRIGHT school is just the difference in cost between the two types of schools.

TABLE A17—ESTIMATED BENEFITS FOR EACH TYPE OF INTERVENTION

	Fraction enrolled	Enrollment	Total scores
Panel A: Estimates at the discontinuity			
Selected villages	0.553	230.048	0.367
Non-selected villages	0.368	153.088	-0.042
Panel B: Village level averages			
With BRIGHT schools	0.589	245.024	0.388
With government schools	0.451	187.616	0.042

Notes: Estimates in Panel A are taken from regressions similar to those presented in Tables 5 and 7. The estimates for the non-selected villages are taken from regressions similar to those in column 2 but without the department level fixed effects. We calculated the estimate for the selected villages by adding the estimate for the non-selected villages to our estimate of the treatment effect from our preferred specification in column 1 of Tables 6 and 7. The estimates presented in Panel B are created using the same methodology as those in Panel A but using the estimates from columns 1, 2, 4, and 5 of Table 8 instead.

TABLE A18—COST EFFECTIVENESS OF BRIGHT AS IMPLEMENTED

	Enrollment		Test scores	
	Scenario I	Scenario II	Scenario I	Scenario II
Panel A: Costs				
BRIGHT villages	$9,956	$9,921	$24,890	$24,803
Non-selected villages	$5,198	$4,517	$12,995	$11,293
Difference in costs	$4,758	$5,404	$11,894	$13,510
Panel B: Outcomes				
BRIGHT villages	230	230	0.37	0.37
Non-selected villages	153	153	-0.04	-0.04
Difference in outcomes (i.e., impacts)	77	77	0.41	0.41
Panel C: Cost effectiveness				
Enrollment (one additional student per year)	$61.82	$70.22		
Test scores (one tenth of a standard deviation in two years)			$6.99	$7.94

Notes: This table presents the estimated cost effectiveness of the BRIGHT program as implemented. Panel A summarizes the estimated costs. For enrollment, these are annual costs. For test scores, the costs are calculated over 2.5 years. Panel B provides the estimates' gains due to the program based on the impact estimates provided in Tables 5, 6, and A17. Finally, Panel C provides the estimated cost effectiveness in US$ 2007.

TABLE A19—COST EFFECTIVENESS OF THE BRIGHT-SPECIFIC AMENITIES

	Enrollment		Test scores	
	Scenario I	Scenario II	Scenario I	Scenario II
Panel A: Costs				
BRIGHT schools	$10,659	$10,659	$26,647	$26,647
Government schools	$8,198	$7,035	$20,494	$17,588
Difference in costs	$2,461	$3,623	$6,153	$9,058
Panel B: Outcomes				
BRIGHT schools	245	245	0.39	0.39
Government schools	188	188	0.04	0.04
Difference in outcomes (i.e., impacts)	57	57	0.59	0.59
Panel C: Cost effectiveness				
Enrollment (one additional student per year)	$42.87	$63.12		
Test scores (one tenth of a standard deviation in two years)			$4.26	$6.27

Notes: This table presents the estimated cost effectiveness of the amenities that are unique to the BRIGHT program. Panel A summarizes the estimated costs. For enrollment, these are annual costs. For test scores, the costs are calculated over 2.5 years. Panel B provides the estimates' gains due to the program based on the impact estimates provided in Tables 8 and A17. Finally, Panel C provides the estimated cost effectiveness in US$ 2007.

TABLE A20—COST EFFECTIVENESS ESTIMATES OF OTHER EDUCATION INTERVENTIONS ON SCHOOL ENROLLMENT

Intervention	Country	Cost Eff.	Study
Extra teachers (OB)	India	$2.81	Chin (2005)
Deworming	Kenya	$4.36	Miguel and Kremer (2004)
Iron and deworming	India	$34.31	Bobonis, Miguel, and Sharma (2004)
Village-based schools	Afghanistan	$39.57	Burde and Linden (2011)
School meals	Kenya	$43.34	Vermeersch and Kremer (2005)
Teacher incentives	India	$67.64	Duflo, Hanna, and Ryan (2012)
School construction	Indonesia	$83.77	Duflo (2001)
School uniforms (a)	Kenya	$95.82	Evans, Kremer and Ngatia (2008)
School uniforms (b)	Kenya	$130.82	Kremer, Moulin, and Namunyu (2003)
Cash incentives for teachers	Kenya	No impacts	Glewwe, Nauman, and Kremer (2003)
Textbook provision	Kenya	No impacts	Glewwe, Kremer, and Moulin (2003)
Flip chart provision	Kenya	No impacts	Glewwe, Kremer, Moulin, and Zitzewitz (2004)

Notes: Cost needed to achieve an impact of one additional student enrolled in school per year. Measured in US$ 2007 (Evans and Ghosh 2008; He, Linden, and MacLeod 2008; Kremer, Miguel, and Thornton 2008). The estimates in this table are different from the ones presented in Evans and Ghosh (2008) for two reasons: first, their estimates were in US$ 1997, whereas we have expressed them in US$ 2007. Second, they presented "education budget cost effectiveness" of interventions, which accounts for the deadweight loss associated with raising the necessary funds, whereas we present the original estimates given by the authors of the studies (adjusted to US$ 2007).

TABLE A21—COST EFFECTIVENESS ESTIMATES OF OTHER EDUCATION INTERVENTIONS ON TEST SCORES

Intervention	Country	Cost Eff.	Study
Teacher training program	India	$0.22	He, Linden, and MacLeod (2008)
Remedial ed (tutors or "Balsakhi")	India	$0.97	Banerjee, Cole, Duflo, and Linden (2007)
Computer-assisted learning (PicTalk)	India	$1.00	He, Linden, and MacLeod (2008)
Additional teachers with student tracking	Kenya	$2.41	Duflo, DuPas, and Kremer (2008)
Village-based schools	Afghanistan	$3.24	Burde and Linden (2011)
Teacher incentives (India)	India	$3.98	Duflo, Hanna, and Ryan (2012)
Girls' scholarship	Kenya	$4.07	Kremer, Miguel, and Thornton (2009)
Teacher incentives (Kenya)	Kenya	$4.34	Glewwe, Nauman, and Kremer (2003)
Textbooks	Kenya	$5.30	Glewwe, Kremer, and Moulin (2003)
Computer-assisted learning (CAL)	India	$7.22	Banerjee, Cole, Duflo, and Linden (2007)
Educational vouchers	Colombia	$41.34	Angrist et al. (2002)
Deworming	Kenya	No impacts	Miguel and Kremer (2004)
Flip chart provision	Kenya	No impacts	Glewwe, Kremer, Moulin, and Zitzewitz (2004)
Child sponsorship program	Kenya	No impacts	Kremer, Moulin, and Namunyu (2003)

Notes: Cost needed to achieve an impact of one additional student enrolled in school per year. Measured in US$ 2007 (Evans and Ghosh 2008; He, Linden, and MacLeod 2008; Kremer, Miguel, and Thornton 2008). The estimates in this table are different from the ones presented in Evans and Ghosh (2008) for two reasons: first, their estimates were in US$ 1997, whereas we have expressed them in US$ 2007. Second, they presented "education budget cost effectiveness" of interventions, which accounts for the deadweight loss associated with raising the necessary funds, whereas we present the original estimates given by the authors of the studies (adjusted to US$ 2007).