The First- and Second-Generation Impacts of Free Secondary Education: Experimental Evidence from Ghana

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based on two papers:

"The impact of Secondary School Subsidies on Career Trajectories in a Dual Labor Market"
with Esther Duflo and Michael Kremer

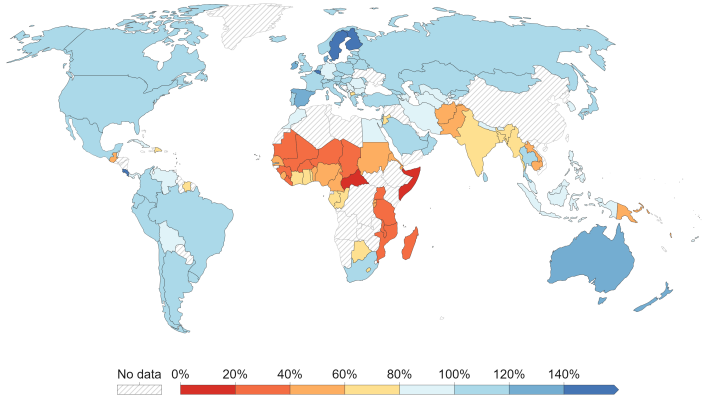
"Intergenerational Impacts of Secondary Education: Experimental Evidence from Ghana"
with Esther Duflo, Liz Spelke and Mark Walsh

October 20, 2023

Gross enrolment ratio in secondary education, 2022

Our World in Data

Number of children of any age group who are enrolled in lower secondary[1] and upper secondary[2] education expressed as a percentage of the total population of the official secondary school age.



Source: UNESCO Institute for Statistic via World Bank (2023) OurWorldInData.org/primary-and-secondary-education • CC BY

Note: Gross enrolment rate can surpass 100% when including students outside the official age due to early or late admissions and grade repetition.

1. Lower secondary education: Lower secondary education (ISCED 2) lays the foundation for lifelong learning and broader educational opportunities through subject-specific theoretical instruction.

Introduction

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- Others are less optimistic
  - Secondary education is expensive, and making secondary school free would generate a transfer to the generally wealthier households already sending their children to secondary school ("infra-marginals")
  - Will it really increase enrollment?
  - Will students learn? (Hanushek and Woessman 2008)
  - Will they learn something useful?
    - Is the curriculum adapted for a terminal secondary degree or merely a preparation for tertiary education? (Goldin, 1999)

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  - Will they get jobs?
    - High unemployment among the educated
    - In many low income countries, secondary education serves as a first funnel limiting access to coveted and rationed government jobs (such as teachers, nurses, or local administrators).
    - High wage premia and other perks for public sector jobs for those with tertiary education (Aryeetey and Baah-Boateng, 2016; Barton et al., 2017).
    - Massive queuing for government jobs and overoptimistic expectations (Banerjee and Sequiera 2020, Bandiera et al. 2020, Abebe et al. 2020).

Background: Ghana's Education System and Status Quo in 2008

Enrollment

Primary School enrollment

Junior High School enrollment

Senior High School enrollment

- Free Primary and Junior High School, but Senior High School (SHS) was not free
  - Annual tuition for day SHS student: 20% of per capita GDP
- SHS admission conditional on score on standardized exam at end of JSS
- 2008: Girls 20% less likely to enroll in SHS

Ghana Secondary School Scholarships Study

Research Question

Examine impact of making secondary education free, holding admission criteria constant

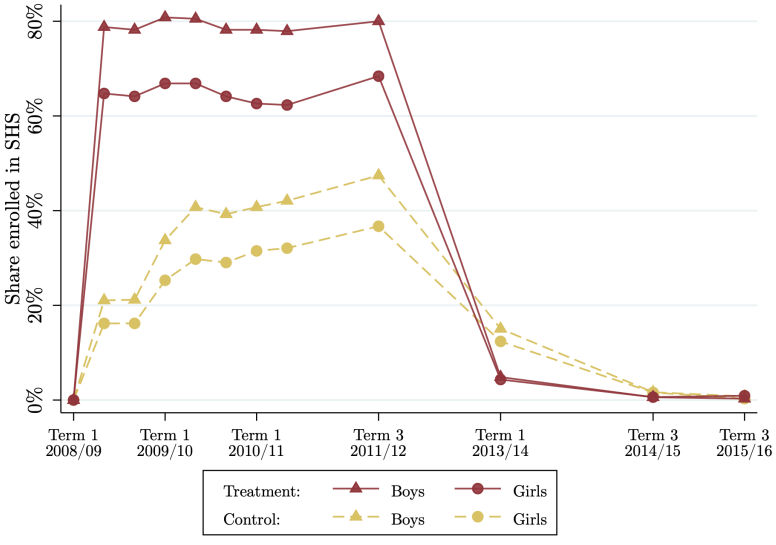
Study Design

- Ongoing longitudinal study started in Sep. 2008 in partnership with Government of Ghana
- 2,064 students (50% female) admitted to secondary school but had not enrolled by end of first term
- Lottery: 682 received 4-year scholarship to attend local senior high school (SHS)

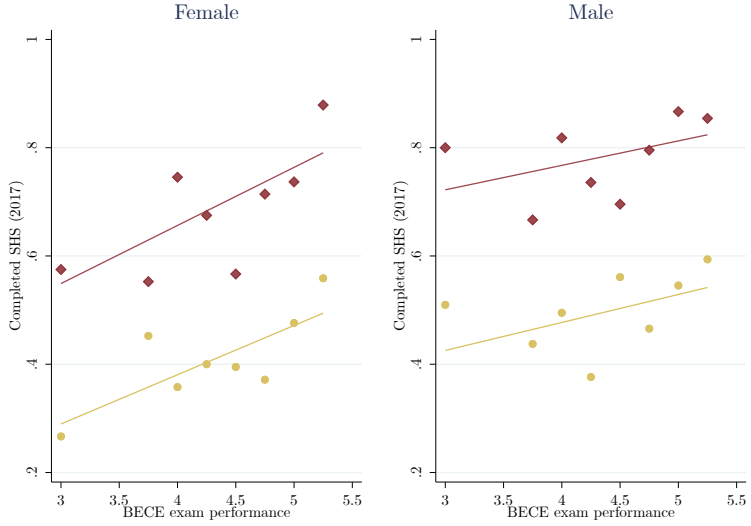
Ghana

Free SHS debate at the core of the presidential election campaigns of 2008, 2012, 2016, (2020)

Scholarships had a large impact on SHS enrollment



Impact across initial test score distribution



Secondary Education Outcomes

	(1) Total years of education to date (2013)	(2) Total cognitive score (2013)	(3) Completed SHS (2017)	(4) Total years of SHS (2017)	(5) Completed TVI	(6) Total years of education to date (2022)	(7) Total years of tertiary to date (2022)
Panel A: Female							
Treatment	1.186***	0.194***	0.274***	1.198***	-0.013	1.455***	0.234***
	(0.114)	(0.069)	(0.032)	(0.119)	(0.013)	(0.167)	(0.078)
P-value	0.000	0.005	0.000	0.000	0.315	0.000	0.003
Step-down p-val	0.010	0.030	0.010	0.010	0.465	0.010	0.020
Comparison mean	10.575	-0.175	0.398	1.651	0.044	11.056	0.323
N	1036	1002	997	983	998	860	880
Panel B: Male							
Treatment	1.183***	0.113*	0.282***	1.310***	-0.046***	1.178***	0.077
	(0.101)	(0.059)	(0.030)	(0.103)	(0.014)	(0.156)	(0.087)
P-value	0.000	0.054	0.000	0.000	0.001	0.000	0.377
Step-down p-val	0.010	0.149	0.010	0.010	0.030	0.010	0.465
Comparison mean	11.006	0.183	0.497	2.066	0.078	11.806	0.444
N	1028	981	973	961	975	844	867
P-val male=fem	0.963	0.371	0.745	0.375	0.083	0.278	0.202

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

Fiscal Cost of Free SHS policy

- Scholarship winners = 3.09 years in SHS; non-scholarship winners = 1.86
  - Scholarship paid for 3.09 years of education per 1.23 additional years in our sample.
  - Cost of free education: Upper bound: no effect of scholarship on JHS pass rate
  - Assume 60% of qualified students complete SHS regardless, other 40% behave like our sample
  - Free SHS requires paying for 7.2 years of schooling for each additional year of attainment.
  - The fiscal cost per additional secondary school graduate would be approximately $3,680.
- If promise of free secondary education leads 25% of students not passing exam to pass
  - Free SHS requires paying for 4.9 years of schooling for each additional year of SHS attainment. Fiscal cost: $2,600.
  - Important margin: only 40% of those who start JHS pass final exam

What does it mean for the debate on free secondary education?

- Ghana passed Free SHS policy in 2017....but the debate continues
- Proponents focus on benefits
- Opponents focus on costs
  - Many "inframarginals" – people who would have paid on their own.
- Our studies: quantifies the benefits
  - Many domains

Two sets of impacts measured

1. Impacts on study participant themselves ("**first generation**") (Duflo, Dupas, Kremer 2023)
   - Compare life outcomes for those who won the scholarship lottery with those who did not
   - Educational attainment, cognitive skills
   - Labor market outcomes
   - Measurement: in-person survey in 2013, yearly phone surveys since 2015. Last completed round in 2022.
   - Minimal attrition (<3% up to 2019) thanks to cell phone subsidy. Hurt by COVID: attrition 15% in 2022, 20% in 2023.

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2. Spinoff study: Impacts on their children ("**second generation**") (Duflo, Dupas, Spelke and Walsh 2023)
   - Child survival to age 5
   - Cognitive development

Outline

1. First Generation
2. Model
3. Beyond the labor market
4. Second Generation

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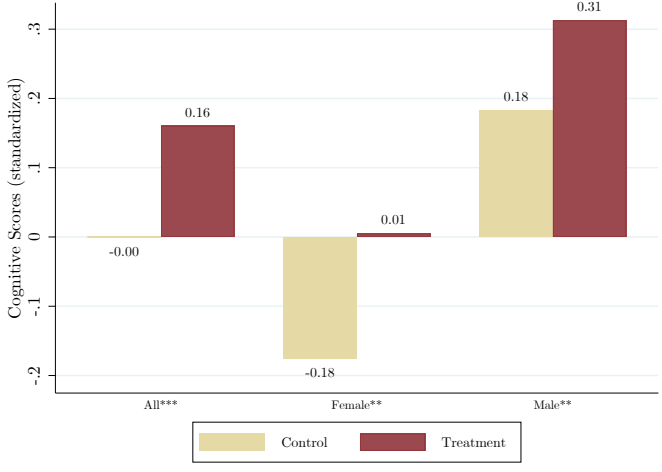
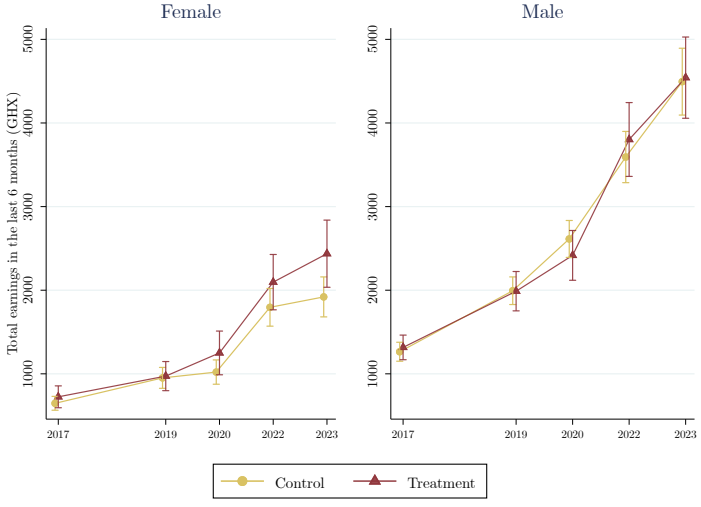
Higher Scores on Cognitive Test (2013)

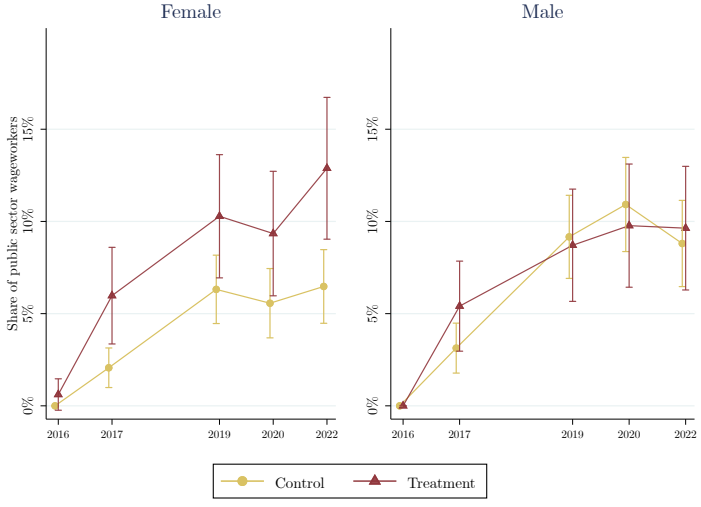
...Though gender gap remains large



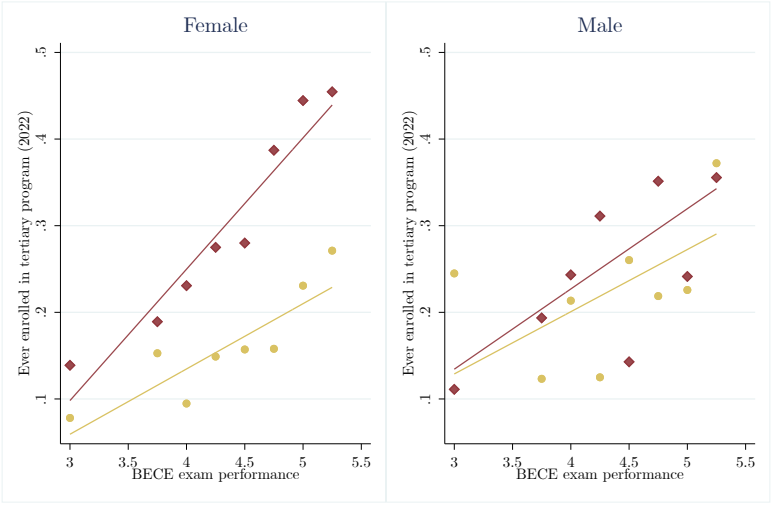
Impacts on Labor Market Outcomes - Earnings over prior 6 Months



Impacts on Labor Market Outcomes - Public Sector Employment



Tertiary Education (gateway to government jobs)



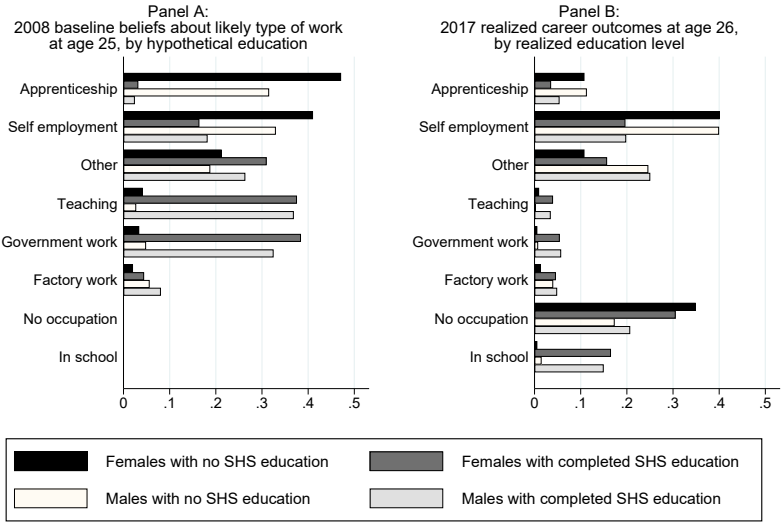
Recap: Underwhelming Labor Market Returns in the Medium Run

	(1) Worked for pay in past 6 months (2019)	(2) Worked for pay in past 6 months (2023)	(3) Has wage contract with employer (2019)	(4) Public sector employee (2019)	(5) Public sector employee (2023)	(6) Self-employed (2019)	(7) Self-employed (2023)	(8) Total earnings in the last 6 months (2023)
Panel A: Female								
Treatment	0.033	0.025	0.041**	0.041**	0.067***	-0.012	-0.095***	570.514**
	(0.033)	(0.034)	(0.019)	(0.019)	(0.023)	(0.031)	(0.037)	(233.032)
P-value	0.314	0.462	0.032	0.031	0.003	0.683	0.009	0.015
Step-down p-val	0.891	0.970	0.267	0.267	0.010	0.970	0.158	0.158
Comparison mean	0.602	0.678	0.063	0.063	0.067	0.287	0.496	1920.065
N	986	833	986	986	833	986	833	831
Panel B: Male								
Treatment	-0.020	0.048*	0.035	-0.003	0.012	-0.042	-0.055*	96.228
	(0.024)	(0.025)	(0.023)	(0.019)	(0.023)	(0.026)	(0.032)	(318.633)
P-value	0.405	0.057	0.119	0.874	0.596	0.106	0.085	0.763
Step-down p-val	0.970	0.465	0.594	0.970	0.970	0.614	0.554	0.970
Comparison mean	0.864	0.833	0.106	0.092	0.108	0.201	0.284	4494.203
N	966	824	965	966	822	966	824	810
P-val male=fem	0.207	0.648	0.856	0.092	0.071	0.536	0.435	0.219

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

COVID period Difference in network help

Labor market outcomes fall far short of expectations...



Not giving up hope? Education Plans

Years of queueing for tertiary

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Plans to apply				Ever applied		Ever accepted
	2013	2017	2019	2022	2017	2019	2022	
Panel A: Female								
Treatment	0.266	0.150	0.179	0.133	0.149	0.160	0.202	0.144
	(0.032)	(0.033)	(0.033)	(0.029)	(0.031)	(0.031)	(0.033)	(0.030)
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Step-down p-val	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Comparison mean	0.364	0.427	0.286	0.139	0.211	0.233	0.245	0.197
N	1001	997	986	883	997	986	883	1020
Panel B: Male								
Treatment	0.211	0.144	0.114	0.051	0.097	0.098	0.115	0.071
	(0.032)	(0.032)	(0.034)	(0.031)	(0.032)	(0.033)	(0.035)	(0.031)
P-value	0.000	0.000	0.001	0.094	0.002	0.003	0.001	0.023
Step-down p-val	0.010	0.010	0.010	0.099	0.010	0.020	0.010	0.069
Comparison mean	0.500	0.555	0.450	0.208	0.286	0.329	0.366	0.279
N	978	973	966	873	973	966	873	999
P-val male=fem	0.253	0.879	0.169	0.073	0.240	0.163	0.083	0.096

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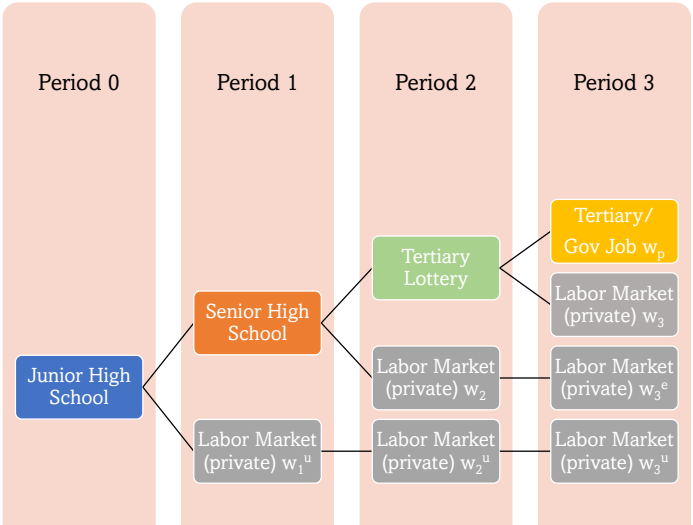
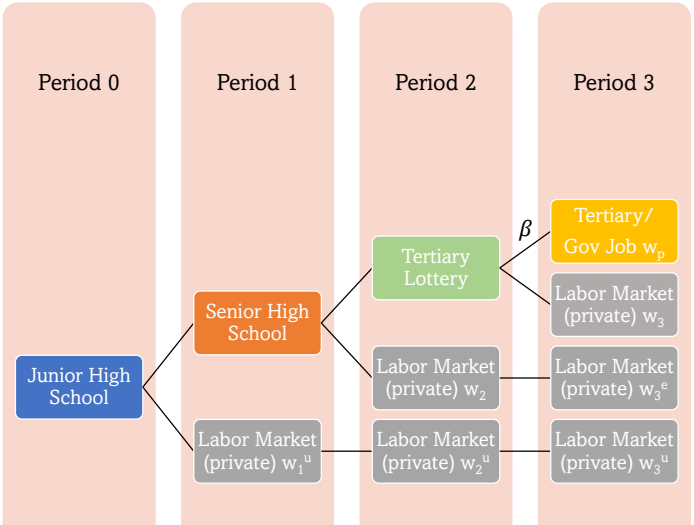
Outline

Simple Harris-Todaro style model to explain results

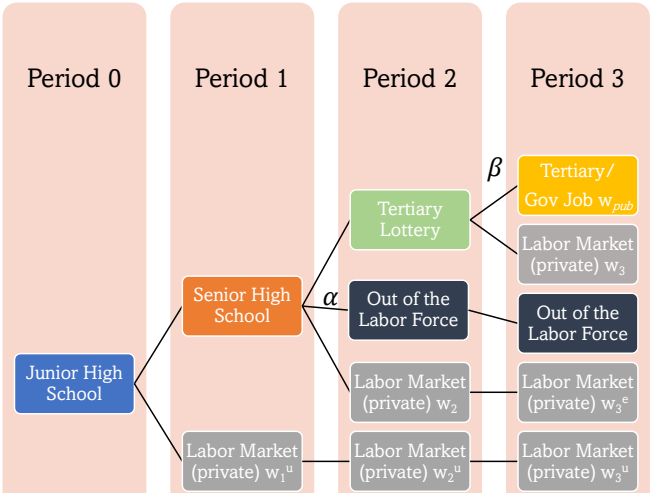


Expectations re: odds to win tertiary lottery drive choice

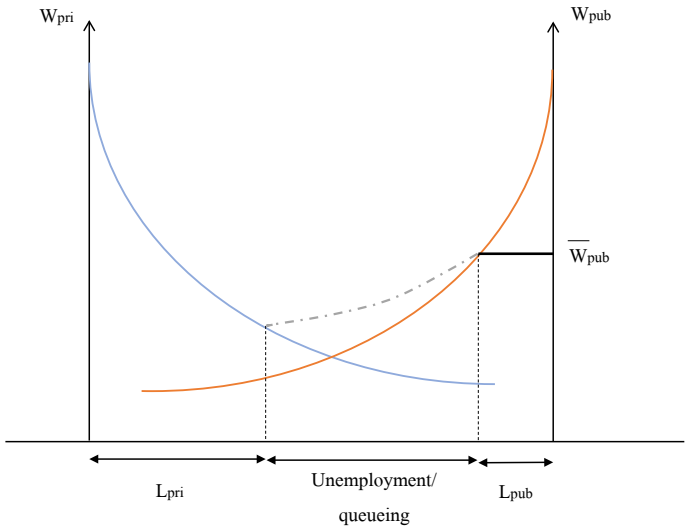


How do we explain gender differences?

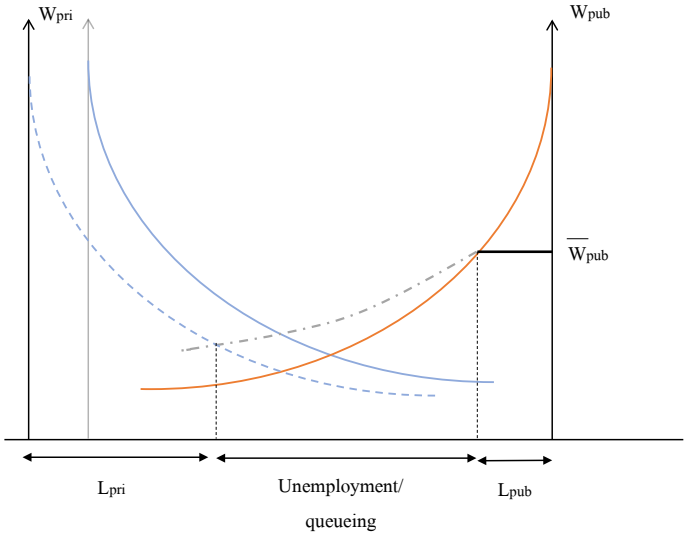
Some HHs credit constrained + Lower HH investment in girls' education if risk that women drop out of LF



- Harris-Todaro framework
- Private vs. Public
- Fixed public sector wage $\overline{W}_{pub}$
  - Investment in education depends on *expected income*
  - unemployment/queueing in equilibrium



- GE effects of Free Secondary Education
  - Larger pool of graduates
  - Expectations do not adjust right away
  - Increase in unemployment



Policy Implications

- In this highly stylized model, free secondary school for all is not a good policy
  - creates a glut of secondary school graduates
  - aggregate impact of having a large cohort of young people underemployed for long periods impact may well be greater than the direct productivity gains of educating them better.
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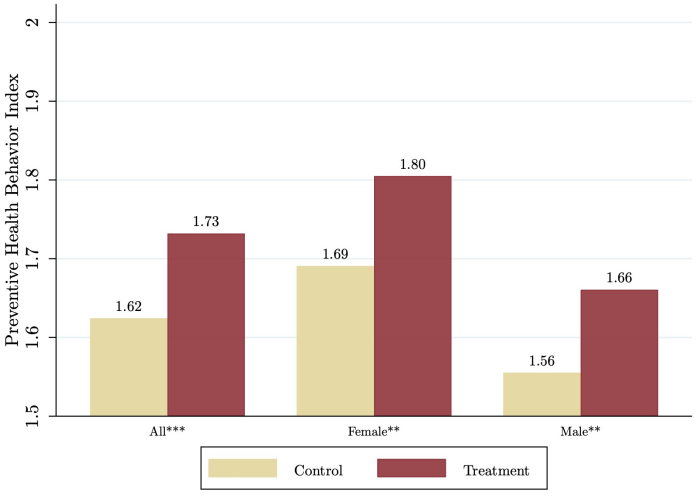
- But secondary school could have benefits that are not captured by the model, especially for girls (Duflo et al. 2023)
- Free secondary with complementary policies?
  - Lower rents in gov sector?
  - Cap opportunities to apply for tertiary programs: e.g., one-shot through competitive examinations before end of secondary school

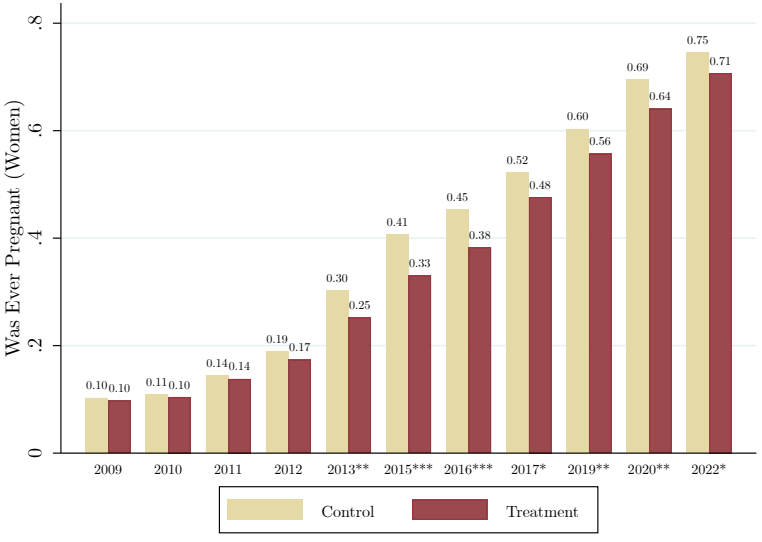
Outline

Beyond the Labor Market

- Higher Take-up of Preventive Health Behaviors (2013)
- Sum over 3 behaviors measured:
  - Hand-washing with soap
  - bed net use
  - use of repellent



Delayed fertility (and marriage) for Women



Impact of Scholarship on Fertility and Marriage

	(1) Ever pregnant/ had a pregnant partner (2013)	(2) Had unwanted first pregnancy (full sample) (2013)	(3) Number of children ever had (2019)	(4) Number of children ever had (2023)	(5) Ever lived with partner (2016)	(6) Currently married or cohabitating (2019)	(7) Still living with parents (2019)	(8) Most recent partner completed tertiary education (2019)
Panel A: Female GYS participants								
Treatment	-0.069**	-0.067**	-0.152*	-0.290***	-0.121***	-0.062*	0.003	0.071*
	(0.033)	(0.032)	(0.082)	(0.106)	(0.033)	(0.034)	(0.033)	(0.039)
P-value	0.039	0.038	0.065	0.007	0.000	0.067	0.933	0.071
Comparison mean	0.483	0.390	1.332	2.124	0.498	0.475	0.355	0.195
N	1009	985	986	833	1007	986	986	575
Panel B: Male GYS participants								
Treatment	-0.018	-0.012	-0.026	-0.035	-0.058**	-0.047	0.078**	-0.051**
	(0.020)	(0.017)	(0.060)	(0.094)	(0.026)	(0.030)	(0.031)	(0.022)
P-value	0.368	0.475	0.671	0.712	0.027	0.117	0.011	0.021
Comparison mean	0.112	0.075	0.568	1.208	0.229	0.291	0.242	0.072
N	982	980	965	824	988	965	966	371
P-val male=fem	0.210	0.136	0.246	0.102	0.138	0.703	0.097	0.008

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

Outline

Impacts on offspring?

(Duflo, Dupas, Spelke and Walsh 2023)

Multiple potential channels through which the transfer (scholarship) to adolescents could affect offspring health and cognitive development:

- Lower fertility – more resources for each child
- Increased health knowledge
- Better parenting skills – research in cognitive science suggests that interactions with educated adults enhance children's intuitive skills and prepare them for school
- Higher valuation of education – higher willingness to invest
- Higher bargaining power for women and improved marriage market prospects
- Higher, less volatile income

Offspring Study: Challenges

- Fertility impact on youth complicates measurement of impacts on offspring
- If we take a snapshot of offspring outcomes now, offspring of scholarship recipients will be younger/fewer.
  - Because of age gradient in HAZ score (Cummins 2017), difficult to compare health outcomes between e.g. 6-mo and 18-mo old.
  - Scholarship winners who started childbearing early despite scholarship maybe negatively selected

Implications for Offspring study

- Need to measure children when they reach a specific age:
  - Based on cognitive science and pediatric psychology literature, we chose three critical age windows: 14-18 months (infants); 39-45 month (3.5yr) and 60 to 69 months (5yr).
- So once every youth has had their first child and that child has reached 18 months, we are able to compare "health of the first born at age 18 mo" between scholarship T and C groups.
- Same once the firstborns have all reached 3.5 years... 5 years...
- Around 2,500 child-caregiver pairs surveyed over 6.5 years (2017-2023)

▸ Caregiver-child surveys by year ▸ Scholarship effect on parents ▸ GYS respondent-level survey rates

What do we measure?

- Detailed caregiver survey to illuminate the channels through which parent education affects early childhood development.
- Health: Survival, Height and weight
- Cognitive development

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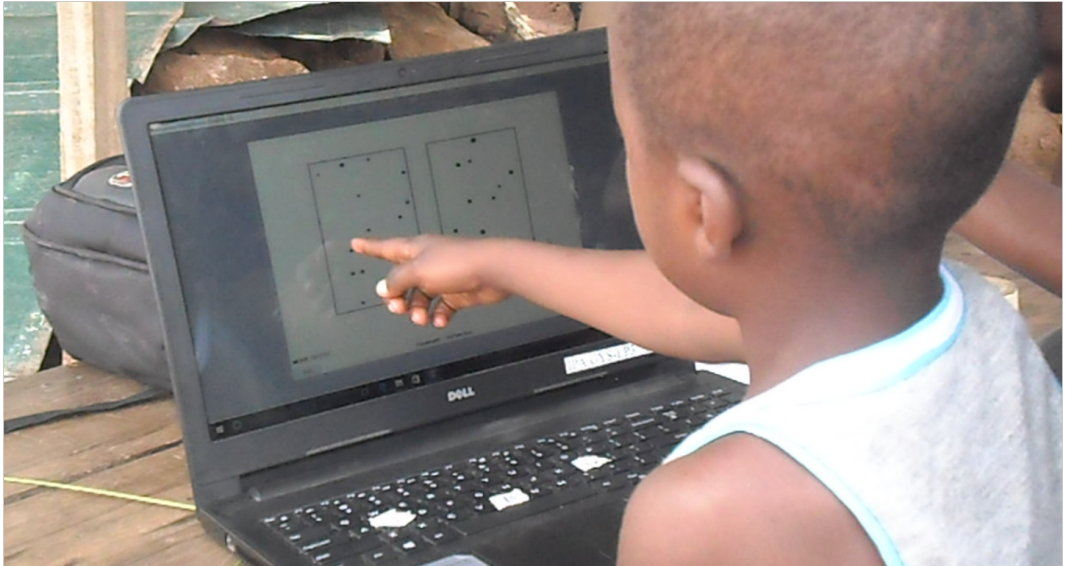
- Cognitive development
  - Suite of interactive games (using a mix of physical materials and computers) test the level of a child's development in pre-mathematics, language, social cognition, and executive functions.
  - These tests have been extensively piloted in the lab and field:
    - developed in partnership with Elizabeth Spelke's lab for development studies in Harvard's psychology department.
    - based on frontier research, but can be administered by a trained team of local field officers (i.e. do not rely on a trained psychologist).

5 year-old games



3 year-old games

Infant games

Child Survival

	(1) Survived to one yr (2023)	(2) Survived to three yrs (2023)	(3) Survived to one yr (2023)	(4) Survived to three yrs (2023)
Panel A: Children of Female GYS participant				
Treatment	0.020**	0.016*	0.019**	0.016*
	(0.009)	(0.010)	(0.009)	(0.009)
P-value	0.033	0.090	0.037	0.089
Comparison mean	0.955	0.956	0.955	0.956
N	1773	1459	1773	1459
Panel B: Children of Male GYS participant				
Treatment	0.016	0.009	0.014	0.006
	(0.011)	(0.011)	(0.011)	(0.011)
P-value	0.158	0.401	0.209	0.590
Comparison mean	0.960	0.970	0.960	0.970
N	985	728	985	728
P-val male=fem	0.215	0.299	0.288	0.304
Linear Year of birth Control	✓	✓		
Year of birth Fixed Effects			✓	✓

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

Children's Cognitive Development

	(1) 1.5 years	(2) 2.5 years	(3) 3.5 years	(4) 5 years	(5) 7 years
Panel A: Children of Female GYS participant					
Treatment	-0.078	-0.027	0.038	0.247***	0.253**
	(0.095)	(0.128)	(0.079)	(0.084)	(0.118)
P-value	0.411	0.834	0.625	0.003	0.033
Comparison mean	0.007	0.032	-0.026	0.017	0.056
N	563	274	630	668	361
Panel B: Children of Male GYS participant					
Treatment	0.134	-0.218	-0.008	-0.215*	-0.112
	(0.118)	(0.153)	(0.095)	(0.124)	(0.187)
P-value	0.257	0.157	0.932	0.084	0.551
Comparison mean	-0.012	-0.037	0.049	-0.041	-0.118
N	342	208	345	300	174
P-val male=fem	0.306	0.280	0.728	0.003	0.089

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

▸ Robustness to Scoring Decisions ▸ Household Composition ▸ Mechanism: child health and location

Mechanisms: Caregiver Characteristics, Aspirations and Beliefs

	(1) Caregiver is Mother	(2) Completed Secondary Education	(3) Earns income	(4) SES index	(5) Depression index	(6) Aspiration: child's years of education	(7) Beliefs: Child development
Panel A: Children of Female GYS participant							
Treatment	-0.004	0.242***	0.023	0.117	-0.030	0.023	0.068
	(0.017)	(0.040)	(0.030)	(0.073)	(0.070)	(0.040)	(0.064)
P-value	0.802	0.000	0.445	0.111	0.664	0.559	0.285
Comparison mean	0.906	0.220	0.746	-0.006	0.040	16.751	0.051
N	3070	2745	2745	2732	2729	2715	2730
Panel B: Children of Male GYS participant							
Treatment	0.031	0.006	-0.049	0.009	-0.202**	0.086	0.112
	(0.024)	(0.036)	(0.034)	(0.092)	(0.089)	(0.068)	(0.086)
P-value	0.192	0.870	0.146	0.925	0.024	0.208	0.193
Comparison mean	0.740	0.196	0.818	0.012	-0.072	16.562	-0.091
N	1761	1533	1533	1525	1521	1519	1521
P-val male=fem	0.152	0.000	0.124	0.340	0.132	0.396	0.763

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

▸ SES Index ▸ Cg Depression Index ▸ Child Development Beliefs

Mechanisms: Caregiver Behavior

	(1) Last pregnancy prenatal care index	(2) Preventive health behaviors index	(3) Child stimulation index	(4) Child investment index	(5) Schooling Index
Panel A: Children of Female GYS participant					
Treatment	0.129**	0.128*	0.143**	-0.001	0.027
	(0.057)	(0.066)	(0.059)	(0.052)	(0.069)
P-value	0.023	0.052	0.015	0.981	0.696
Comparison mean	0.022	0.010	-0.012	0.043	0.065
N	795	2732	2728	2731	1825
Panel B: Children of Male GYS participant					
Treatment	0.041	0.007	-0.097	-0.050	0.054
	(0.093)	(0.079)	(0.083)	(0.074)	(0.100)
P-value	0.660	0.933	0.242	0.497	0.586
Comparison mean	-0.036	-0.017	0.020	-0.079	-0.130
N	504	1525	1525	1525	938
P-val male=fem	0.328	0.204	0.016	0.592	0.684

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

Other preventive health behaviors | Child stimulation | Child Investment | Education

LENA Measurements

	(1) Child vocalizations per min	(2) Conversational turns per min	(3) Meaningful speech	(4) Adult word count per min	(5) LENA index
Panel A: Children of Female GYS participant					
Treatment	0.328***	0.067***	0.011*	0.589	0.144
	(0.125)	(0.024)	(0.007)	(0.719)	(0.088)
P-value	0.009	0.005	0.089	0.413	0.104
Comparison mean	1.957	0.336	0.156	12.937	-0.091
N	559	559	559	559	559
Panel B: Children of Male GYS participant					
Treatment	-0.225	-0.048	-0.017*	-2.162**	-0.280**
	(0.162)	(0.030)	(0.009)	(0.951)	(0.120)
P-value	0.167	0.112	0.053	0.024	0.021
Comparison mean	2.217	0.381	0.171	14.315	0.128
N	389	389	389	389	389
P-val male=fem	0.010	0.004	0.014	0.024	0.007

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

Example of LENA device

Cost-benefit analysis of child mortality reduction

Assumptions	Cost per recipient	Mort. effect	$ per death averted	$ per LY	VSLY	B-C ratio
Female; VSLY-to-GDP pc=3	337.2	-0.016	9922.32	283.49	20958	73.93
Female; VSLY-to-GDP pc=6.5	337.2	-0.016	9922.32	283.49	45409.0	160.18
Female; VSLY-to-GDP pc=33.5	337.2	-0.016	9922.32	283.49	234031.0	825.52
All; VSLY-to-GDP pc=3	739.2	-0.016	21751.41	621.47	20958	33.72
All; VSLY-to-GDP pc=6.5	739.2	-0.016	21751.41	621.47	45409.0	73.07
All; VSLY-to-GDP pc=33.5	739.2	-0.016	21751.41	621.47	234031.0	376.58

VSLY stands for value of a statistical life year. In row 1 and 2, we use the WHO's standard for cost-effectiveness (three times GDP per capita). We use the World Bank's estimate of GDP per capita in Ghana in 2021 ($2445). In row 3 and 4, we use a stated-preference willingness-to-pay estimate of the VSLY per GDP per capita from an experiment in Burkina Faso (a neighboring country to Ghana). In row 5 and 6, we use the stated-preference willingness-to-accept estimate from Burkina Faso (Traumtmann et al. 2021). In rows 1-3, cost per recipient is estimated as the average cost of paying for the years of secondary school of the mother who received the scholarship. In rows 4-6, we perform the same analyses but assuming both men and women would be eligible for scholarships, which raises the cost of the program while leaving the mortality impact unchanged. The cost per school year of the program was $120. The mortality effect is the estimated treatment effect on survival until 3 years old. With a discount rate of .03 and a age-weight parameter of .04, we estimate that each death averted translates to 35 additional life years to calculate '$ per LY' (life years) and the 'B-C ratio' (benefit-cost ratio) column. The benefit-cost ratio measures the ratio of benefits (converted into $) over the monetary costs.

Conclusion and policy implications

- Free secondary education leads to significant gains in educational achievement and cognitive scores
- But in a world with an attractive and rationed government sector, expanding secondary school may have no or little labor market impacts for many years, while new graduates wait for the opportunity to get one of these jobs.
  - This may be particularly problematic early on, when parents and students may overestimate their chance of success
- YET — there are significant non-market gains to secondary education (particularly on child health and human capital), especially for women $\rightarrow$ *enough to make free secondary education a cost-effective policy to reduce child mortality (even if it was the only impact)*.
- Suggests secondary school scholarships should be paired with a reform of government hiring to prevent excess queuing, for example short window of application, or a limited number of attempts.

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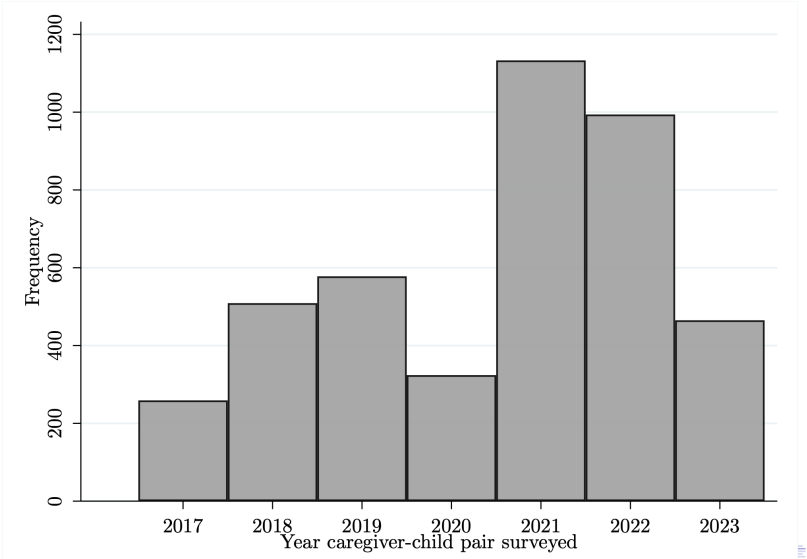
- Suggests secondary school scholarships should be paired with a reform of government hiring to prevent excess queuing, for example short window of application, or a limited number of attempts.

- Key role of maternal education in child outcomes. No effect of paternal education alone.

Thank you!

Distribution of caregiver-child in-person surveys by year



Scholarship-eligible parent-level survey rates

	(1) F	(2) M	(3) T-F	(4) C-F	(5) T-M	(6) C-M
Ever had a child	0.765	0.498	0.749	0.774	0.497	0.499
	(0.424)	(0.500)	(0.435)	(0.419)	(0.501)	(0.500)
Any child ever elig. during tracking	0.675	0.448	0.665	0.679	0.434	0.456
	(0.469)	(0.498)	(0.473)	(0.467)	(0.496)	(0.498)
All children too old when tracking began	0.0705	0.0263	0.0599	0.0755	0.0259	0.0265
	(0.256)	(0.160)	(0.238)	(0.264)	(0.159)	(0.161)
Any child ever surveyed	0.618	0.381	0.611	0.621	0.376	0.384
	(0.486)	(0.486)	(0.488)	(0.485)	(0.485)	(0.487)
Refused surveying of children	0.0135	0.0117	0.0150	0.0128	0.00287	0.0162
	(0.116)	(0.107)	(0.122)	(0.113)	(0.0536)	(0.126)
Any child surveyed if had child	0.807	0.766	0.816	0.803	0.757	0.770
	(0.395)	(0.424)	(0.388)	(0.398)	(0.430)	(0.422)
Seven: Any child ever surveyed if had child	0.304	0.201	0.300	0.306	0.179	0.212
	(0.460)	(0.401)	(0.459)	(0.461)	(0.385)	(0.410)
Five: Any child ever surveyed if had child	0.571	0.420	0.548	0.582	0.393	0.434
	(0.495)	(0.494)	(0.499)	(0.494)	(0.490)	(0.496)
Three: Any child ever surveyed if had child	0.569	0.449	0.608	0.551	0.480	0.434
	(0.496)	(0.498)	(0.489)	(0.498)	(0.501)	(0.496)
18 mo: Any child ever surveyed if had child	0.532	0.492	0.540	0.529	0.491	0.493
	(0.499)	(0.500)	(0.499)	(0.500)	(0.501)	(0.501)
Observations	1036	1028	334	702	348	680

Implications for offspring study

Direct Impact of Scholarship on Education Outcomes: GYS participants with at least one child surveyed

	(1) Total standardized score (2013)	(2) Total years of education to date (2019)	(3) Completed SHS (2019)	(4) Completed tertiary (2019)	(5) Most recent partner's years of education (2019)
Panel A: Female GYS participants					
Treatment	0.236**	1.483***	0.282***	0.050**	0.606**
	(0.091)	(0.191)	(0.041)	(0.021)	(0.280)
P-value	0.010	0.000	0.000	0.019	0.030
Comparison mean	-0.357	10.416	0.284	0.036	10.851
N	612	605	612	612	551
Panel B: Male GYS participants					
Treatment	0.041	1.377***	0.301***	0.035	-0.733**
	(0.100)	(0.204)	(0.052)	(0.028)	(0.322)
P-value	0.682	0.000	0.000	0.220	0.023
Comparison mean	0.019	11.048	0.371	0.052	9.792
N	370	379	381	381	329
P-val male=fem	0.150	0.715	0.766	0.596	0.001

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

Implications for offspring study

Robustness to Scoring Decisions: unattempted questions scored as incorrect

	(1) 1.5 years	(2) 2.5 years	(3) 3.5 years	(4) 5 years	(5) 7 years
Panel A: Children of Female GYS participant					
Treatment	-0.112	-0.022	0.054	0.246***	0.246**
	(0.100)	(0.129)	(0.081)	(0.084)	(0.118)
P-value	0.266	0.862	0.502	0.003	0.038
Comparison mean	0.008	0.019	-0.021	0.017	0.057
N	563	274	630	668	361
Panel B: Children of Male GYS participant					
Treatment	0.127	-0.213	-0.010	-0.223*	-0.113
	(0.118)	(0.152)	(0.096)	(0.124)	(0.187)
P-value	0.285	0.161	0.920	0.074	0.545
Comparison mean	-0.014	-0.023	0.040	-0.039	-0.119
N	342	208	345	300	174
P-val male=fem	0.235	0.261	0.616	0.003	0.094

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

Cognitive Development

Household composition

	(1) Caregiver is Father	(2) Caregiver is Grandmother	(3) Lives with Mother	(4) Lives with Father	(5) Lives with both parents	(6) Number of siblings from GYS respondent	(7) Number of adults in household	(8) First-born child
Panel A: Children of Female GYS participant								
Treatment	0.000	0.006	-0.009	0.004	0.011	0.032	0.036	0.051*
	(0.006)	(0.014)	(0.014)	(0.034)	(0.031)	(0.069)	(0.089)	(0.031)
P-value	0.981	0.661	0.524	0.905	0.717	0.640	0.682	0.099
Comparison mean	0.013	0.061	0.933	0.643	0.540	1.917	2.382	0.358
N	3070	3070	3027	2682	3082	2979	2722	2979
Panel B: Children of Male GYS participant								
Treatment	-0.015	-0.023	0.022	-0.088**	-0.074**	0.151*	0.080	-0.007
	(0.017)	(0.015)	(0.019)	(0.039)	(0.037)	(0.092)	(0.099)	(0.039)
P-value	0.384	0.124	0.241	0.023	0.045	0.099	0.415	0.849
Comparison mean	0.158	0.077	0.888	0.711	0.551	1.416	2.369	0.540
N	1761	1761	1597	1644	1770	1680	1520	1680
P-val male=fem	0.311	0.124	0.126	0.097	0.097	0.317	0.961	0.257

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

Cognitive Development

Mechanisms: Child Health and Location

	(1) Caregiver reported child health index	(2) Physical development index	(3) Child lives in urban area	(4) Under 3 yrs when began creche/daycare/nursery
Panel A: Children of Female GYS participant				
Treatment	0.082*	-0.049	0.007	0.020
	(0.047)	(0.036)	(0.036)	(0.029)
P-value	0.079	0.172	0.844	0.494
Comparison mean	0.055	-0.005	0.446	0.756
N	2731	2603	2875	1825
Panel B: Children of Male GYS participant				
Treatment	-0.019	-0.085	-0.030	0.036
	(0.076)	(0.061)	(0.042)	(0.040)
P-value	0.799	0.163	0.484	0.369
Comparison mean	-0.099	0.009	0.404	0.682
N	1525	1475	1640	938
P-val male=fem	0.291	0.540	0.559	0.627

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

Cognitive Development

Math and Numeracy Development

	(1) 2.5 years	(2) 3.5 years	(3) 5 years	(4) 7 years
Panel A: Children of Female GYS participant				
Treatment	0.022	0.095	0.166**	0.261**
	(0.132)	(0.079)	(0.084)	(0.117)
P-value	0.867	0.233	0.050	0.026
Comparison mean	-0.006	-0.014	0.033	0.060
N	274	630	668	361
Panel B: Children of Male GYS participant				
Treatment	-0.172	0.077	-0.069	-0.008
	(0.146)	(0.101)	(0.132)	(0.192)
P-value	0.241	0.449	0.603	0.968
Comparison mean	0.008	0.027	-0.079	-0.125
N	208	345	300	174
P-val male=fem	0.313	0.888	0.159	0.243

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

Language Skills Development

	(1) 18 months	(2) Three	(3) Five	(4) Seven
Panel A: Children of Female GYS participant				
Treatment	0.018	-0.004	0.169*	0.431***
	(0.089)	(0.095)	(0.096)	(0.136)
P-value	0.836	0.964	0.079	0.002
Comparison mean	-0.034	-0.002	-0.010	-0.065
N	532	503	547	250
Panel B: Children of Male GYS participant				
Treatment	-0.131	-0.081	-0.472***	0.120
	(0.092)	(0.132)	(0.131)	(0.257)
P-value	0.155	0.538	0.000	0.641
Comparison mean	0.073	0.003	0.021	-0.220
N	310	250	224	106
P-val male=fem	0.299	0.741	0.001	0.575

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

Spatial Reasoning

	(1) Three	(2) Five	(3) Seven
Panel A: Children of Female GYS participant			
Treatment	0.136	0.226**	0.449***
	(0.101)	(0.093)	(0.138)
P-value	0.179	0.016	0.001
Comparison mean	-0.058	0.006	-0.077
N	504	547	251
Panel B: Children of Male GYS participant			
Treatment	0.009	-0.203	0.017
	(0.141)	(0.131)	(0.324)
P-value	0.946	0.123	0.957
Comparison mean	0.025	-0.048	-0.217
N	251	224	107
P-val male=fem	0.472	0.013	0.334

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

Social Cognitive Development

	(1) Three	(2) Five	(3) Seven
Panel A: Children of Female GYS participant			
Treatment	0.121	-0.068	0.228
	(0.183)	(0.101)	(0.145)
P-value	0.510	0.504	0.116
Comparison mean	-0.158	0.001	0.026
N	154	546	251
Panel B: Children of Male GYS participant			
Treatment	-0.303	-0.005	0.321
	(0.249)	(0.161)	(0.311)
P-value	0.226	0.978	0.305
Comparison mean	0.167	0.074	-0.282
N	105	224	106
P-val male=fem	0.319	0.627	0.855

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

SES: Index Components

	(1) Number of bedrooms per adult equivalent	(2) Food consumption per adult equivalent	(3) Metal sheet roof	(4) Mud walls (reversed)
Panel A: Children of Female GYS participant				
Treatment	0.012	-3.427	0.008	-0.020
	(0.014)	(2.735)	(0.012)	(0.026)
P-value	0.394	0.211	0.507	0.433
Comparison mean	0.400	66.888	0.959	0.155
N	2201	2202	2428	2429
Panel B: Children of Male GYS participant				
Treatment	0.020	-4.998	0.006	-0.037
	(0.019)	(4.099)	(0.015)	(0.040)
P-value	0.304	0.223	0.706	0.352
Comparison mean	0.406	74.585	0.965	0.253
N	1144	1149	1285	1285
P-val male=fem	0.732	0.697	0.785	0.659

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

Caregiver Characteristics

Caregiver Depression: Index Components

	(1) Felt bothered more in past week	(2) Trouble focusing in past week	(3) Felt sad in past week	(4) Things took more effort in past week	(5) Felt hopeful in past week	(6) Felt fearful in past week	(7) Restless sleep in past week
Panel A: Children of Female GYS participant							
Treatment	-0.009	-0.110	-0.024	0.020	-0.141	-0.071	-0.060
	(0.077)	(0.077)	(0.090)	(0.086)	(0.089)	(0.060)	(0.074)
P-value	0.912	0.154	0.793	0.820	0.112	0.237	0.418
Comparison mean	4.218	4.370	3.984	3.998	2.205	4.590	4.294
N	2429	2429	2429	2429	2428	2429	2429
Panel B: Children of Male GYS participant							
Treatment	0.028	-0.120	-0.096	-0.101	0.174	-0.055	-0.047
	(0.099)	(0.103)	(0.114)	(0.118)	(0.128)	(0.086)	(0.105)
P-value	0.777	0.248	0.401	0.396	0.175	0.525	0.650
Comparison mean	4.153	4.195	3.895	3.811	2.189	4.427	4.254
N	1285	1283	1285	1285	1285	1285	1285
P-val male=fem	0.788	0.995	0.657	0.450	0.044	0.903	0.859

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

Caregiver Characteristics

Caregiver Child Development Beliefs: Index Components

	(1) Believes parents should sing songs to child before turns 6 mos	(2) Believes parents should read stories to child before turns 1	(3) Believes should talk to child in full sentences before turns 1
Panel A: Children of Female GYS participant			
Treatment	0.046	-0.031	-0.046**
	(0.029)	(0.021)	(0.023)
P-value	0.117	0.135	0.040
Comparison mean	0.586	0.170	0.237
N	1442	1437	1441
Panel B: Children of Male GYS participant			
Treatment	0.041	0.024	0.007
	(0.037)	(0.030)	(0.033)
P-value	0.269	0.415	0.841
Comparison mean	0.617	0.180	0.259
N	819	815	817
P-val male=fem	0.937	0.201	0.281

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

Caregiver Characteristics

Other Preventive Health Behaviors: Index Components

	(1) Took child for check-up in past 12 mo	(2) Child sleeps under mosquito net	(3) Toilet quality index	(4) HH has priv. toilet	(5) Treats child's drinking water	(6) Main drinking source: Sachet/bottled water
Panel A: Children of Female GYS participant						
Treatment	-0.003	0.047	-0.011	0.037	-0.001	-0.048
	(0.021)	(0.035)	(0.077)	(0.028)	(0.012)	(0.038)
P-value	0.897	0.175	0.887	0.186	0.931	0.205
Comparison mean	0.371	0.626	2.481	0.198	0.048	0.547
N	2211	2211	1473	1476	2211	2211
Panel B: Children of Male GYS participant						
Treatment	-0.038	0.074*	0.036	-0.014	-0.005	0.009
	(0.028)	(0.045)	(0.098)	(0.034)	(0.022)	(0.048)
P-value	0.180	0.099	0.717	0.683	0.834	0.858
Comparison mean	0.418	0.606	2.430	0.171	0.065	0.535
N	1156	1156	852	852	1156	1156
P-val male=fem	0.452	0.661	0.885	0.172	0.762	0.307

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

Caregiver Behavior

Child Stimulation: Index Components

	(1) Sang to child in past month	(2) Read to child in past month	(3) Told stories to child in past month	(4) Played with child in past month	(5) Named/counted/drew with child in past month
Panel A: Children of Female GYS participant					
Treatment	0.051*	0.016	0.026	0.029**	0.058**
	(0.026)	(0.027)	(0.031)	(0.015)	(0.024)
P-value	0.051	0.555	0.401	0.049	0.017
Comparison mean	0.642	0.613	0.382	0.879	0.672
N	2208	2205	2202	2207	2206
Panel B: Children of Male GYS participant					
Treatment	-0.026	0.027	-0.054	-0.051**	-0.009
	(0.040)	(0.040)	(0.039)	(0.025)	(0.040)
P-value	0.516	0.493	0.165	0.044	0.818
Comparison mean	0.657	0.510	0.379	0.910	0.638
N	1150	1153	1152	1154	1153
P-val male=fem	0.060	0.944	0.085	0.005	0.072

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

Caregiver Behavior

Child Investment: Index Components

	(1) Child ate protein in the morning	(2) Child ate protein in the evening	(3) Number of books	(4) HH has writing materials
Panel A: Children of Female GYS participant				
Treatment	-0.018	0.023	-0.055	0.001
	(0.028)	(0.016)	(0.128)	(0.020)
P-value	0.512	0.155	0.667	0.952
Comparison mean	0.661	0.887	1.518	0.780
N	2082	2150	2193	2203
Panel B: Children of Male GYS participant				
Treatment	0.002	0.010	-0.077	-0.052
	(0.037)	(0.023)	(0.140)	(0.034)
P-value	0.959	0.667	0.584	0.133
Comparison mean	0.645	0.872	1.150	0.718
N	1115	1130	1148	1149
P-val male=fem	0.777	0.664	0.876	0.216

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

Caregiver Behavior

Education: Index Components

	(1) Currently attends school	(2) Currently private school	(3) Mins. in school per day	(4) Attended preschool	(5) Pre-closure in school	(6) Pre-closure private school
Panel A: Children of Female GYS participant						
Treatment	0.022	0.022	-1.077	0.019	-0.002	0.042
	(0.020)	(0.038)	(11.125)	(0.032)	(0.018)	(0.040)
P-value	0.274	0.570	0.923	0.567	0.910	0.297
Comparison mean	0.873	0.550	445.939	0.751	0.933	0.618
N	1247	1247	1428	1428	1428	1428
Panel B: Children of Male GYS participant						
Treatment	0.023	0.035	3.535	0.017	0.013	-0.009
	(0.032)	(0.054)	(18.808)	(0.050)	(0.034)	(0.053)
P-value	0.461	0.520	0.851	0.742	0.693	0.873
Comparison mean	0.823	0.457	406.695	0.649	0.877	0.559
N	587	587	659	659	659	659
P-val male=fem	0.966	0.887	0.850	0.989	0.867	0.350

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

Caregiver Behavior

Labor Outcomes During COVID Crisis

	(1) Worked for pay in past 6 months (2020)	(2) Has wage contract with employer (2020)	(3) Total earnings in past 6 months (2020)	(4) Total earnings April (2020)	(5) Coeff. of variation of monthly earnings (if > 0) (GHX) (2020)
Panel A: Female					
Treatment	0.056*	0.067***	247.666*	65.718***	-10.068
	(0.034)	(0.021)	(149.415)	(24.709)	(6.173)
P-value	0.096	0.001	0.098	0.008	0.103
Step-down p-val	0.406	0.020	0.366	0.040	0.406
Comparison mean	0.631	0.049	1021.076	116.919	89.384
N	866	862	836	853	518
Panel B: Male					
Treatment	0.027	0.027	-197.349	-7.020	5.515
	(0.021)	(0.024)	(187.767)	(42.645)	(5.038)
P-value	0.191	0.263	0.294	0.869	0.274
Step-down p-val	0.644	0.644	0.644	0.891	0.644
Comparison mean	0.887	0.113	2613.083	387.389	67.696
N	885	880	848	874	740
P-val male=fem	0.463	0.221	0.075	0.159	0.047

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

back

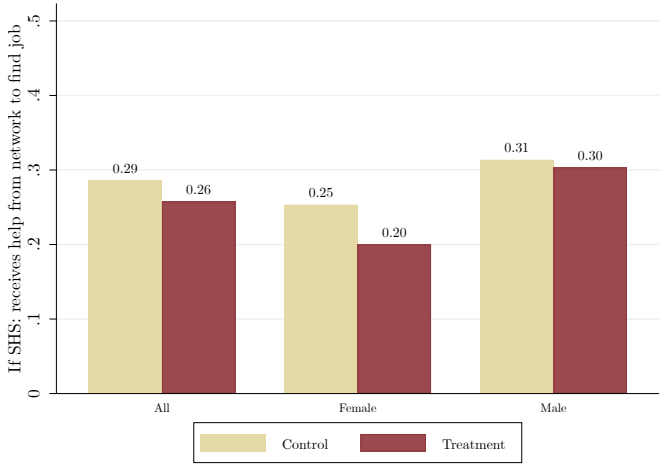
OLS estimates: returns to education

	(1)	(2)	(3)	(4)	(5)	(6)
	Total earnings in the last 6 months					Child survived
	2017	2019	2020	2022	2023	to three yrs
Panel A: Female						
Years of SHS	33.8	140.9***	142.6***	309.4***	308.3***	-0.004
	(23.5)	(38.0)	(41.1)	(65.8)	(68.8)	(0.005)
P-value	0.151	0.000	0.001	0.000	0.000	0.434
Comparison mean	579.0	737.0	773.6	1280.1	1467.5	0.957
Effect size (%)	5.84	19.11	18.44	24.17	21.01	-0.40
N	646	636	545	562	541	917
Panel B: Male						
Years of SHS	-37.3	-11.1	66.4	127.9	293.8***	0.005
	(30.3)	(44.6)	(61.2)	(83.2)	(108.9)	(0.006)
P-value	0.219	0.804	0.278	0.125	0.007	0.447
Comparison mean	1331.4	2046.1	2513.6	3330.1	4011.1	0.959
Effect size (%)	-2.80	-0.54	2.64	3.84	7.32	0.49
N	603	597	539	536	505	408

*** p<0.01, ** p<0.05, * p<0.1
Note: Control group only.

◂ Introduction

If completed SHS: receives help from network to find jobs



Labor Table

LENA Device and T-Shirt

LENA Measurements