The Impact of Secondary School Subsidies on Career Trajectories in a Dual Labor Market: Experimental Evidence from Ghana*

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Abstract

In 2008, we randomly assigned secondary school scholarships among 2,064 youths in Ghana. This paper exploits fifteen years of follow-up data to examine the impact of access to free secondary education on career trajectories over the first part of the life cycle. Winning a scholarship increases the probability of secondary school graduation from 45% (in the control group) to 73% (in the treatment group), and leads to an increase in knowledge and skills. However, the entry of secondary school graduates (with or without scholarship) in the labor market is very gradual, as many attempt, over many years, to qualify for tertiary programs that are gateways for government jobs. By 2023, 12% of females and 15% of males in the control group have completed a tertiary program. The scholarship increases this share by 11 percentage points for females, but not at all for males. We do not observe significant labor market impacts for men at any point. In contrast, earnings gains of around 24% arise in 2020 and grow to 30% in 2023 for female scholarship recipients, who are 6.7 percentage points (100%) more likely than non-recipients to have a government job by then. We use a simple Harris-Todaro style model of a dual labor market with credit constraints to (a) explain the gendered impacts and (b) discuss the impact that generalized free secondary education would be expected to have in general equilibrium, under different regimes of hiring in the government sector.

Keywords: scholarships, girl's education, queuing, returns to education, gender

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1 Introduction

In many African countries, secondary education is currently either not subsidized, or only partially subsidized, and remains accessible to a relatively small group of young people. Current financing for education in sub-Saharan Africa is below internationally recommended levels. While the United Nations states that, "Following the Incheon and Paris Declarations, governments shall allocate at least 4-6% of GDP and at least 15-20% of total public expenditure to education,"[1] the current level for Ghana is at 2.9%, and the continent's median at 3.5% of GDP, according to the World Bank Development Indicators. The IMF estimates that *doubling* education expenditures as a share of GDP will be required for the sub-continent to achieve the Sustainable Development Goal of universal primary and secondary school enrollment by 2030. A first order question in the context of limited budgets is the labor market impact of free secondary education for beneficiaries.[2]

In a standard competitive labor market, the impact of subsidizing secondary education on future earnings would depend primarily on the human capital gains of attending secondary school for the marginal students, the productivity gain caused by this increase in human capital (minus the loss due to the years of lost experience), and any long run impact of the financial transfer to the inframarginal students. But in many low income countries, secondary education also serves as a first funnel limiting access to coveted and rationed government jobs (such as teachers, nurses, or local administrators). Wage premia and other perks for public sector jobs are often high (Aryeetey and Baah-Boateng, 2015; Barton et al., 2017). However, these positions often require qualifying for additional training or screening exams which are used to allocate scarce jobs, potentially requiring long periods of waiting for uncertain results.

Against this setting, what are the labor market impacts of secondary school scholarships? Are the marginal students trying (and succeeding) to get government jobs? Do they end up queuing for a long time for the right post-secondary training and job? It is difficult to use cross-sectional data to answer this question, since sorting into queuing based on ability generates a misleading age earnings profile and Mincerian estimates of the returns to education, as shown for Ghana and Tanzania by Rankin et al. (2010).

[1] See https://www.un.org/en/transforming-education-summit/financing-education

[2] Another key question is whether secondary education has positive externalities which are not taken into account by parents or young people when making their education decisions. In a companion paper (Duflo et al., 2024), we use the same experiment to look at one such externality, the impact on survival and human capital of the next generation.

We analyze a randomized controlled trial with a 15-year follow-up, in which randomly selected students who had qualified to attend secondary school but had not been able to enroll due to lack of funds received the offer of a full scholarship. This unusually long follow-up gives us the opportunity to compare labor market trajectories of scholarship recipients and non-recipients over the first part of their life cycle (up to age 32 or so). This is important because one key feature of the dual labor market is a very long wait time as students attempt multiple times to qualify.

Access to senior high school in Ghana has historically been limited, with a gateway exam administered at the end of grade 8, which only roughly 40% of junior high school entrants passed as of the onset of this study. Moreover, until 2017, there were substantial annual tuition fees, corresponding to about 20% of GDP per capita.[3] Our study generated experimental variation in the cost of secondary school by providing secondary school scholarships to some randomly selected youth in Ghana, while keeping educational requirements the same. In 2008, full scholarships were awarded to 682 adolescents, randomly selected among a study sample of 2,064 rural youth who had gained admission to a public high school but did not enroll within the first school term because they were not able to pay the fee. Follow-up data were collected regularly until 2023, when these youth were on average 32 years old. By 2019, we had a minimal attrition rate (6%). Attrition increased after the COVID crisis and associated disruption in field work, and was around 20% in 2023, our last year.

Scholarships increased educational attainment. While 45% of non-winners were eventually able to obtain a secondary education, scholarship winners were 28 percentage points (63%) more likely to do so, and they received 1.26 more years of secondary education than non-winners on average. The increase in education translated into an increase in cognitive skills and knowledge. Five years into the study, scholarship winners scored on average 0.16 standard deviations higher on a series of practical math and reading comprehension questions modeled on the Programme for International Student Assessment (PISA).

At baseline, students saw a secondary school degree mainly as the gateway to a government job. In particular, respondents often thought they would be a teacher or a nurse. Consistent with these expectations, when we surveyed them in 2013, 95% of secondary school graduates in both the control and treatment groups planned to apply to a tertiary program. But access to tertiary programs is extremely rationed, so very few students enroll every year. Remarkably, however,

[3] A complete senior high school education, currently three years, would cost about 70% of GDP per capita, when additional clothing, exam and material fees are included.

they continue trying for a very long time. By 2023 (ten years after they graduated from secondary school), 22% of secondary school graduates in the control group had indeed enrolled at some point, and 17% had not *but were still planning* to enroll some day.

On average, by 2022, 37 percent of men in the control group had ever applied for a tertiary program, 20% had ever enrolled in one, and another 21% stated they intended to apply in the future. For women, these figures were 25%, 14% and 14%, respectively. Compared to the control group, male scholarship winners were more likely to have ever applied (+11.5 percentage points) and to still be intending to apply (+5 percentage points), but not significantly more likely to have ever enrolled (+1.8 percentage point, p-value of 0.54). The impacts are much larger for female scholarship winners: they are 20 percentage points more likely to have ever applied (close to double), 12.5 percentage points more likely to have ever enrolled, and 13 percentage points more likely to still hope to enroll (p-value<0.05 in all cases).

One consequence of this arduous path to tertiary education is that, even 10 years after having completed secondary school, a non-trivial share of individuals are still focused on gaining tertiary education rather than acquiring experience in the labor market, which has implications for labor market returns. Up to 2019, we did not observe any significant impact of the scholarships on average earnings. For women, a significant impact emerges in 2020 (+24%, p-value<0.1), which persists until 2023 (+30%, p-value<0.05). The gains are partly accounted for by those who got jobs as public employees (typically teachers or nurses): among winners, the likelihood of being a public sector worker increased by 4.1 percentage points (or 65%) in 2019 and 6.7 percentage points (+100%) in 2023 (p-value<0.05 in both cases). Earnings of women in the government sector are about three times as high as the earnings of women who earned anything in the last six months but are not in the government sector.

Motivated by these results, we follow Rankin et al. (2010) and propose a simple model inspired by the Harris-Todaro dual economy model in which households invest in education taking into account labor market effects in the private sector, and education-based rationing of public sector jobs that carry rents. The model has three periods. In period 1, the student invests in secondary school if they (and their parent) choose to. If they do not, they join the labor market. In period 2, the secondary school graduates can choose whether to apply for a lottery to access a government job. Their probability of success depends on how many other people apply, and their own ability. While they apply, they have to remain unemployed, and if they choose not to apply, they can join

the labor market.[4] In the third period, applying for the government job lottery is not possible any more; students who have won the lottery have a government job, while students who have not gotten a government job join the labor market. In period one, the number of people who choose to attend secondary school depends on the cost of education and on how likely they think it is that they can get a government job. In this respect, it seems that students had overly optimistic views on the probability of obtaining public sector positions. At baseline, 70% of students thought they would be a government employee by the age of 25 if they completed senior high school. As a result, they anticipated returns to education of 275% on average. This number is consistent with the expectations of parents for their children, which were collected by Osei et al. (2022) in the Ghana Panel Survey in 2017: there, parents anticipated average returns of secondary education of 350% for their children if they participated in the labor force (similar for boys and girls).

In turn, this creates a large glut of eligible candidates, and low probability of success in period 2. In sharp contrast with expectations, only 6% of those who completed senior high school had a government job by the age of 26, and 8% by age 28. In period 2, we assume that the expectations of secondary school graduates are realistic on average. Nevertheless, as in the Harris-Todaro model, the model predicts that in the second period, many of the secondary school graduates will rationally choose to continue attempting to enroll in tertiary (and remain unemployed while doing so) if the rent associated with the rationed jobs are attractive enough over their lifetime, even if they know that the chance to get them are low. This is precisely what we observe.

In light of the model, our results suggest that 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 and flock to secondary school when it is free. However, in Duflo et al. (2024), we find significant non-market gains to secondary education. In particular, we find large impacts on child survival and on cognitive scores of children of female scholarship recipients. These gains are large enough to make free secondary school a cost-effective policy to reduce child mortality, and the gains on children cognitive scores are valuable as well. Governments may thus want to continue to subsidize education for these reasons. In this case, our model suggest that subsidies for higher education should be paired with a reform of government hiring to prevent excess queuing—for

[4]This is consistent with recent evidence, shown in Donovan et al. (2020), that self-employment and low-wage informal employment are *not* stepping stones to better wage jobs.

example a short window of application, or a limited number of attempts.

Our results also suggest that parents make different choices for boys and girls. The gender difference in tertiary education impacts imply that while the marginal boys induced to attend secondary school by the scholarship were very unlikely to make it to tertiary education, marginal girls induced to attend secondary school made it to tertiary education at almost the same rate as inframarginal girls who would have attended secondary school without scholarships. The model is consistent with those findings, under the parsimonious explanation that women are less likely to stay in the labor force than men, and some families may be credit constrained. A credit constrained family with two children of different gender may thus pay to send a boy to school, even with a low probability of success, rather than a more talented girl.

Our results contribute to a large literature on the impact of education in low- and middle-income countries. There are surprisingly few well-identified studies on the impact of secondary education in this context. We are aware of no randomized controlled trial of the impact of post-elementary education, and of only two studies based on regression discontinuities—one exploiting admission cutoffs in test scores in Kenya (Ozier, 2018) and another, scholarship eligibility cutoffs based on a dropout-risk score in Cambodia (Filmer and Schady, 2014). Our approach can be seen as identifying the impact of relaxing financial constraints to obtaining education, while the regression discontinuity approach can be seen as the impact of relaxing academic qualifications for secondary school; of course the relevant treatment effects may differ (Lang, 1993; Card, 1999). Our paper also contributes to the literature on long term follow-ups of interventions (Gertler et al., 2014; Blattman et al., 2020; Evans and Ngatia, 2020; Banerjee et al., 2020; Hicks et al., 2020). We show that, in this setting, allowing for long-term follow-up is essential to get a comprehensive picture of the impact of free secondary school.

Our paper also contributes to the growing literature on youth unemployment in low-income contexts. High unemployment among the educated is a common challenge throughout the global south, with massive queuing for government jobs and overoptimistic expectations (Banerjee and Sequeira, 2023; Bandiera et al., 2023; Abebe et al., 2023). Our results are consistent with those of Alfonsi et al. (2022) and Bandiera et al. (2023) documenting how distorted beliefs among job seekers in Uganda contribute to prolonging youth unemployment.

A recent working paper by Fujimoto et al. (2023) uses an overlapping generation model to predict the general equilibrium effects of a free secondary education policy. They use our

experimental results to estimate their model, though the model does not emphasize the existence of an attractive government sector, which seems first order in our setting. They find that the estimated model predicts very low GDP and welfare gains from the policy. This result is driven by the fact that their model estimates few households are credit constrained—and therefore, most students who do not enroll pre-policy do so by choice (because the potential returns are low and the opportunity costs are high) rather than due to borrowing constraints. This is somewhat at odds with our experimental result that the scholarship increases secondary school completion rate among the poor by 28 percentage points (their model estimates an impact 25% smaller). Moreover, Ghana's administrative (MIS) data shows that the policy increased overall enrollment by over 20% (rather than 10% in their model).

The paper proceeds as follows. We describe the context in Section 2 and the experimental design and data in Section 3. We present the results on secondary education in Section 4 before we describe the effects on queuing for tertiary jobs and labor market outcomes in Section 5. We provide a framework to think through the results and their implications in Section 6.

2 Context

This section provides background on Ghana's education system and the labor market context throughout our study period.

2.1 Ghana's Education System

Formal education in Ghana begins with two years of kindergarten, six years of primary school, and three years of junior high school. At the end of junior high school, students take the Basic Education Certification Examination (BECE) and those with high enough grades qualify for senior high school (SHS). At the onset of this study, primary and junior high school were free and enrollment rates were close to 95% in primary school and around 75% in junior high. Passing rates were low, with around 70% of junior high school entrants going on to take the BECE and 60% of BECE takers passing. Ajayi et al. (2020) find that 30% of those admitted do not enroll in senior high school the following year. In 2011, government-approved tuition fees for day (non-boarding) students in senior high school were around 500 Ghana cedis per year, a very large sum

in a country where the per capita GDP that year was 2400 Ghana cedis.[5] As of 2010, girls were 6 percentage points (20%) less likely to ever reach senior high school than boys. Some of those who do not enroll in senior high school enroll in Technical and Vocational Institutes (TVIs).[6]

Students who complete senior high school and do well on the senior high school finishing exam (the West African Senior School Certificate Examination or WASSCE) may be admitted to tertiary programs, including degree programs at universities, less prestigious diploma programs, and government training programs. There is a one-year gap between completion of senior high school and admission into university or training colleges. Students who do not score well enough on the exam to secure tertiary admission can retake the WASSCE any number of times.

Tertiary education is expensive. Two government training programs, for nursing and teaching, have historically been subsidized through government stipends, though this policy was put on hold in 2014—initially precluding youth in our study sample from benefiting from the stipends right after graduating from high school.[7] The policy was reinstated (though with stipends cut in half) in 2017, and students in our study cohort were still eligible to apply by then since there is no age limit. These two tertiary programs open the door for the most accessible public sector jobs for the population in our sample. As in many low- and middle-income countries, Ghana has very high premia for public sector positions, particularly those requiring tertiary education. Finan et al. (2015) find a wage premium of at least 59% in Ghana, using the 2013 STEP Skills Measurement Survey. In our own data, controlling for education, hourly earnings among the wage employed are 30 to 40% higher in the public sector, and the premium relative to all jobs (including casual and self employed jobs) is of course much larger. Note that public sector jobs also provide a great deal of job security and they typically carry substantial benefits.

[5] See https://www2.statsghana.gov.gh/docfiles/GDP/EconomicPerformance_2011.pdf

[6] TVI students do not have to take any core academic classes and cannot go on to tertiary. TVIs are a relatively minor part of Ghanas education system, with less than 10% the enrollment of senior high school. In 2008, there were 43,592 full-time TVI students compared to the 486,085 senior high school students (MoE Ghana, 2008).

[7] Between the 1980s and 2013, the government paid allowances large enough to cover all fees to all students enrolled in nursing and teacher training programs, making them effectively fully subsidized for those admitted, and admissions in the programs were capped via a quota system. Both the allowances and the quotas were removed in 2014, taking into effect for the school year starting in September 2014. Our study cohort graduated from SHS in June 2012 and the earliest they could have applied for tertiary was Fall 2012 for a September 2013 start—but given the quotas, having to wait at least two years before getting admission was common, thereby the reform directly affected our study cohort.

2.2 The Macroeconomic Context

The effects we measure should be interpreted as conditional on the macroeconomic context (Rosenzweig and Udry, 2020). Our study participants began senior high school in the 2008/2009 academic year at the earliest. Most participants who completed senior high school did so in June 2012, and our last follow-up survey for this paper was administered in 2023. Ghana had strong macroeconomic performance through the first quarter of 2012, when GDP growth reached an all-time high of 25.0%. But between 2012 and 2016, GDP growth fell each year, reaching a fifteen-year low of 3.6% in 2016. It rebounded in Q2 of 2017 and was strong through 2019. Like many countries, Ghana experienced a contraction in GDP growth in 2020 due to the COVID pandemic's disruptions. After some rebound in 2021, Ghana fell into an economic crisis in 2022 and growth remained weak in 2023.

The government changed their secondary and tertiary education policy during our study period. Starting with the school year 2009/2010, the government shortened the length of senior high school from 4 years back to 3 years (what it was before 2007). Our study participants were thus the last cohort (2008/2009) enrolled in the four-year program. As a result, most of our participants graduated in a double cohort with the students who had enrolled a year later, potentially making it more difficult to quickly enter tertiary education, something they could not have anticipated when they made their decision to enter secondary school.

Government policies affecting the labor market for educated youth began to shift in 2012. In 2008, the government wage bill was 11.3% of GDP, which was the highest of the 12 West African countries surveyed by the World Bank. The Ghanaian government enacted a new salary scale for government employees in 2012, which raised the government wage bill by 38% in one year (IMF, 2012). In 2015, the ballooning wage bill forced the Ghanaian government to accept an IMF loan. As a condition of the loan, the government was required to impose a net hiring freeze on government employment outside health and education departments. The net hiring freeze ended in April 2019.

3 Research Design, Data and Sample Characteristics

3.1 Sampling Frame

The sampling frame was as follows. First, 54 rural districts from five regions were included in the study.[8] Across these 54 districts, we selected 177 publicly funded senior high schools (SHS) accepting only day (i.e., non-boarding) students.[9] These represented about 60% of all SHS in the selected districts as of 2008 (and about 25% of all SHS in the country). They are all co-ed, and typically have over 1,500 students, with an average pupil-teacher ratio of 22. All students officially placed into one of the study SHS as of October 2008 were considered for eligibility.

Students needed to satisfy the following eligibility criteria: (1) having successfully passed the BECE exam and been placed into one of the 177 study SHS by the Computerized School Selection and Placement System (CSSPS),[10] (2) having attended a junior high school in the same district (referred to as in-district students) as the SHS they were admitted to, (3) having not yet enrolled in any SHS (verified through school and home visits) by October 2008 (the school year had started in September).

We surveyed 2,246 students eligible for the study and asked them why they had not enrolled. 95% cited financial difficulties as the main reason, 2% cited pregnancies and 3% cited a variety of other reasons such as being injured, having a job or not liking the school they were placed in.

In early January 2009, we called back the 2,246 eligible students to assess whether they had enrolled or intended to enroll in a senior high school for the second term of the 2008-2009 school year. A total of 182 students who either had enrolled or intended to enroll in the immediate term were dropped from the sample prior to randomization. The scholarship program was only announced to students, headmasters, and surveyors later, so students could not have strategically changed their answer based on the potential to receive scholarships. The final study sample is thus composed of 2,064 individuals (1,028 males and 1,036 females). Among females, 746 had taken the junior high school finishing exam in 2008 and 290 had taken it in 2007.[11]

[8] At the time, there were only 10 regions in Ghana. The three Northern regions and the Volta region were not selected because the Government of Ghana already ran a scholarship program in those regions at the time. Greater Accra was excluded given our focus on poorer areas. We sampled districts from the remaining five regions.

[9] We focused on day students for budget reasons and because we expect more students to be attending day schools as senior high school becomes more common.

[10] The CSSPS is a centralized, merit-based admission system, which is based on the deferred-acceptance algorithm of Gale and Shapley (1962) (Ajayi, 2013).

[11] To ensure we had enough eligible girls in the sample, we had to include girls who had graduated from junior high school in July 2007 and had gained admission into one of the 177 sampled senior high schools one year prior

3.2 Scholarship Program

The scholarship program was implemented by Innovations for Poverty Action (IPA) in Ghana, in partnership with senior high school staff, and the Ghana Education Services, the implementing arm of Ghana's Ministry of Education.

The scholarship covered full tuition and fees for a day student for four years. It was paid directly to the school and covered the entire school bill. A typical bill for a day student is comprised of three items: government approved fees which are applied for all schools, PTA (Parents-Teachers Association) dues, and other levies and supplies, including exam fees. The latter two costs are school-specific. In addition to paying school fees, the scholarship also included payment for the secondary school exit exam (WASSCE). Students who received the scholarship were only responsible for the cost of school materials, transportation to school, and school meals. The total amount paid by the scholarship program varied slightly across courses and schools but averaged approximately 1,921 Ghana cedis (in 2016 GHX terms) per student who completed senior high school. This corresponds to around USD480.

Winners were notified by phone in January 2009 and encouraged to immediately report to their placement SHS (the school where they had been placed into based on their performance on the junior high school finishing exam). SHS headmasters were informed of the names of scholarship winners by phone and received an official letter from the Director-General of the Ghana Education Service and IPA with details on the scholarship scheme. All schools agreed to participate. Scholarship students typically accounted for less than 1% of a cohort in the school.

Enrolling by the start of the second term did not make our scholarship winners particularly unusual, as it is very common for schools to have students enroll late. Ajayi et al. (2020) show that only 44% of students who eventually enroll do so by week 7 of the academic year. Students on the waitlist are notified late in Term 1 if those initially admitted have not reported and can be replaced.

to the rest of the sample but had still not enrolled as of October 2008.

3.3 Interpreting treatment effects: What is a scholarship in economic terms?

This subsection describes the potential channels through which the scholarship program may have affected selected youths and their households.

To start, note that the scholarship affected households differently depending on whether the student would have attended SHS absent the scholarship. The scholarship represents a wealth transfer to families who would have paid for senior high school in the absence of the scholarship. Specifically, for those families (always takers), the scholarship is akin to a GHX 2,328 cash transfer to the family of the student (approximately the yearly GDP per capita) spread across four years.[12] In practice, funds for SHS are often collected from sponsors outside the nuclear family (e.g., aunts or uncles, other relatives), so the average impact on disposable income for infra-marginal families may have been lower.

In contrast, those who go to secondary school due to the scholarship (compliers or "marginal" students) acquire more years of SHS thanks to the scholarship, but they also forego labor market earnings while in school and incur extra expenditure on school materials. Based on our estimates of foregone earnings while in senior high school and extra schooling expenditure over the lifetime of the scholarship (Table B1), we calculate a total cost of GHX 1,294. Reductions in unpaid household labor by students induced to attend senior high school by the scholarship presumably increase this amount, but we do not have the data to put a GHX value on this.

There could also be psychological effects of winning a lottery that are different from the effects of a scholarship per se. We collected data to check for this channel. As shown in Table B1, we do not see large effects on trust, risk or time preferences. We also see no evidence that the scholarship affected confidence levels (column 7 of Table B1). Scholarships could also be affecting effort in school, or other determinants of academic success, by always takers. Hypothetically, scholarships could have increased effort for these infra-marginal students by making them less likely to have been temporarily kicked out of school for failure to pay school fees, or to have experienced stress around this possibility, or by making them more certain that they would be able to afford to complete school. Of course, it is also possible that scholarships reduced effort among these students because they no longer had to fear withdrawal of financial support from their relatives if they did not maintain high academic performance. We do not have data to speak

[12] All numbers reported in 2017 GHX.

to this issue, but note that SHS completion conditional on enrollment is extremely high in both control and treatment groups, suggesting that students may be unlikely to fear having to drop out, leaving little room for a motivating or demotivating effect of the scholarship.

3.4 Data

All our data comes from surveys: a baseline survey conducted in 2008, an extensive 2-hour follow-up survey administered in person in 2013, and 30-min "callback" surveys administered over the phone (unless the respondent could not be reached by phone and had to tracked in person) almost yearly from 2015 to 2023.

3.4.1 Baseline Survey

In November and December of 2008, prior to selecting the students for the scholarship, a baseline survey was administered to the youth themselves as well as to one of their guardians, most commonly the mother. The surveys included questions on perceptions of education, guardian literacy, values and beliefs, as well as modules on members of the household, household living conditions, and assets. After the survey, each student received a basic (non-smart) mobile phone with a sim card and assigned phone number.

3.4.2 Randomization

The final study sample of 2,064 youths was stratified by district, senior high school, junior high school, gender and BECE year. A third of students within each stratum (682 in total) were assigned to the treatment group (a scholarship) while 1,382 students were assigned to the comparison group (no scholarship). Randomization was performed on a computer and, as noted in subsection 3.2, scholarship winners were informed via phone.

3.4.3 Sample Maintenance and Attrition

To enable high follow-up rates, mobile phones were distributed at the onset of the study to every youth in the study (both scholarship winners and non-winners), and study participants were sent mobile phone credit worth about USD 1 twice a year, as an incentive for them to keep the phone number we had on file active. Once a year, we attempted to reach all respondents in order to update their contact information. If they could not be reached over the phone, we attempted to

find them in person by going to their home area. Table A1 presents survey rates across years. In 2017, 9 years after the start of the study, we were able to reach and interview, in phone or in person, 95.4% of our study sample in a few months. In 2019, 11 years after the baseline, the tracking rate was 93.9%. This is remarkably low attrition for a longitudinal study of this kind, particularly for a young-adult, mobile population. Studies that deal with attrition by doing intensive tracking on a random subset of the hard to find subsample and then reweigh have obtained 91% over seven years (Kenya; Duflo et al. (2015)), 84% over ten years (Kenya; Baird et al. (2017)), and 84% over twenty years (Kenya, Hicks et al. (2020)).

Attrition is not differential by treatment group until 2017. During the 2019 survey round, the refusal rate increased from 1% to 2.5% in the control group, while it remained unchanged in the treatment group. This generates a small discrepancy in survey rates across arms, driven by males: male scholarship winners were 2.5 percentage points more likely to be surveyed than non-winners, on a base of 93.1%. The non-winners who refuse the survey appear to have somewhat worse outcomes,[13] suggesting that this differential attrition may if anything lead us to underestimate treatment effects for males when we focus on the 2019 wave. Attrition in 2020 is somewhat larger because we could not do in-person tracking due to COVID-19. We successfully surveyed 84% of respondents on the phone. Attrition was 4.9 percentage points smaller in the treatment group than in the control group. By 2022, we were able to attempt in-person tracking again, but could not trace all those whose contact had been lost during COVID. Table A2 shows the correlates of attrition separately for the treatment and the control groups in 2022 and 2023.

3.4.4 Detailed In-Person Follow-up Survey (2013)

A detailed in-person follow-up survey was conducted from April to August 2013. For many study participants, this follow-up survey fell in the gap year between the end of secondary high school in July 2012 and potential enrollment in tertiary education in September 2013. The survey included modules on schooling, occupation, cognitive skills, labor market expectations, health and fertility, among other things. The cognitive skills module included reading comprehension questions, as well as applied math questions (e.g. profit calculations, reading and interpreting a bar chart, etc.). There were 17 questions, modeled on the OECD PISA exam, tailored to the Ghana context by the research team with inputs from the Assessment Services Unit of the Ghana Ministry of Education.

[13] Regressing the 2017 value for total years of education on refused 2019 survey yields a coefficient of -1.64 (p-value=0.03). For total earnings in the past 6 months the coefficient is -662 GHX (p-value 0.15).

3.4.5 Yearly Callback Surveys

Yearly mini-callbacks were conducted between 2008 and 2014 to update respondents contact information and basic outcomes (education status, fertility). Starting in 2015, the callbacks included a 30-minute survey on major life outcomes, specifically: tertiary education, fertility, partners, labor market activity. A COVID callback was conducted between May and September 2020. The last callback survey was conducted in the Spring 2023.

3.4.6 Outcomes

This paper focuses on educational attainment and labor market outcomes. The impacts on fertility and intergenerational outcomes are reported in a companion paper (Duflo et al., 2024).

We have data on multiple outcomes and over multiple years, which raises the issue of multiple inference. We deal with this by constructing step-down p-values following Romano and Wolf (2005). We organize the outcomes by hypothesis (e.g., secondary education and learning outcomes, tertiary education outcomes, labor market outcomes) and, within each set, compute a set of step-down p-values for results pooled over the full sample, and a second set of step-down p-values for results split by gender (i.e., with twice as many hypotheses).

3.5 Characteristics of Study Sample

Table 1 presents key summary statistics on the study sample and baseline balance. This data comes from baseline surveys administered to the respondents and their guardians in Fall 2008. As a test for balance, we show mean differences across groups for a battery of outcomes. Specifically, we run regressions of the form:

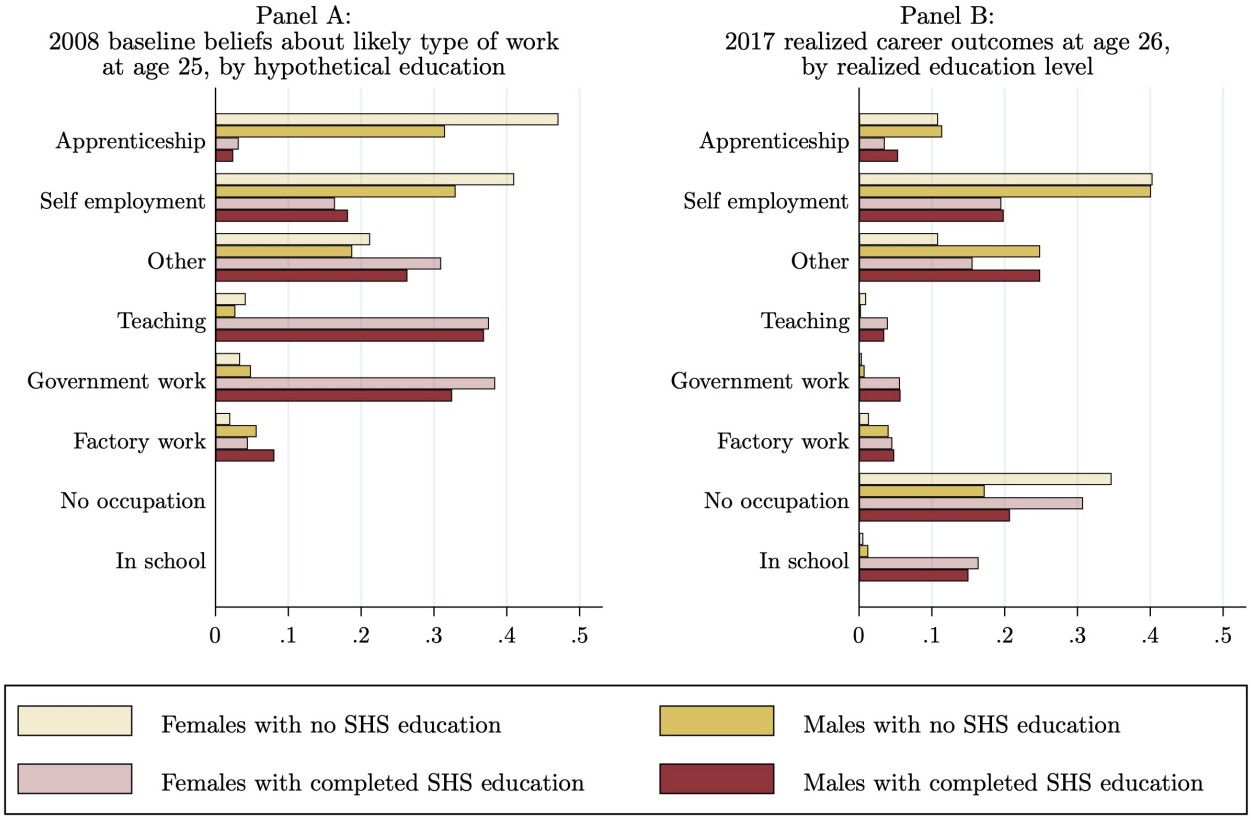
$$Y_i = \alpha + \beta T_i + \epsilon_i \tag{1}$$

where Y is the outcome of interest and T is whether or not the student won a scholarship. Since randomization was at the individual level, we do not cluster standard errors. For each variable of interest, we show $\hat{\beta}$, the difference between the treatment and control group, and its standard error. We also present the mean outcome in the control group. We show the means and estimate the regressions in the full sample in panel A, and by gender in panels B and C. We show results with region fixed effects and a control for junior high school finishing exam (BECE) score.

Students were on average 17 years old at the onset of the study. Our study participants come

from poor households, which is unsurprising since they are drawn from the financially constrained. Over 40% of the students lived in households with no male head and 48% of household heads have only primary education or less, compared to 24% and 35%, respectively, in Ghana as a whole. Additionally, only 17% of household heads have reached at least senior high school, compared to 26% in Ghana as a whole (as per Ghana Statistical Services 2010).

Figure 1: Type of work by education level: Baseline expectations vs. realizations



Notes: Data from 2008 in-person baseline survey of participants (Panel A) and 2017 phone survey (Panel B). SHS stands for Senior High School. In Panel A, respondents (aged 17 on average at the time) were asked in 2008: "If you never go to SHS or continue any other higher education in the future, what types of work do you think you would do when you are 25 years old?" and "Imagine that you complete Senior High School in the future, what types of work do you think you would do when you are 25 years old?" In Panel B, data from the 2017 phone survey on the realized career outcomes of students who did and did not complete SHS is shown. We plot answers separately by respondent gender, pooling treatment and control groups.

Respondents had extremely optimistic beliefs about the returns to secondary education at baseline: the average perceived percentage increase in earnings if one completes senior high school compared to not completing senior high school was 276% in the control group (Table 1, column 7). These high expected average returns are not driven by outliers: 47% thought the returns would

be at least 100%. Panel A of Figure 1 shows that respondents saw a secondary school degree as the gateway to a government job. Over 70% thought they would be a government employee or teaching (a profession dominated by government employees) by the age of 25 if they completed senior high school (81% of females and 65% of males).

3.6 Returns to Secondary Education: Observational Estimates

We begin by briefly presenting evidence on the correlation between secondary education and labor market outcomes in Ghana, using only the control group (those that did not win a scholarship). 35% of secondary school graduates in the control group attend a tertiary program. 16% of them end up with a government job, vs. 1% of those who did not graduate from secondary school.

Table A3 shows OLS estimates of the correlation between earnings and education over time. We show yearly returns in columns 1-3 and returns to SHS completion in columns 4-6. Columns 7-9 show yearly returns in log for the subset with non-zero earnings. Interestingly, in levels, the OLS estimates of the returns to education are not different from zero as of 2017, 4 to 5 years after SHS completion. The returns become large for women as of 2019. For men, the returns to one more year of SHS education become significant only 10 years out.

4 Impacts on Secondary Education and Learning

Considerable evidence suggests that participation in primary school is responsive to school fees, but less is known about how secondary school participation responds to direct costs.[14] This section presents the effects of the scholarship on educational attainment and skills.

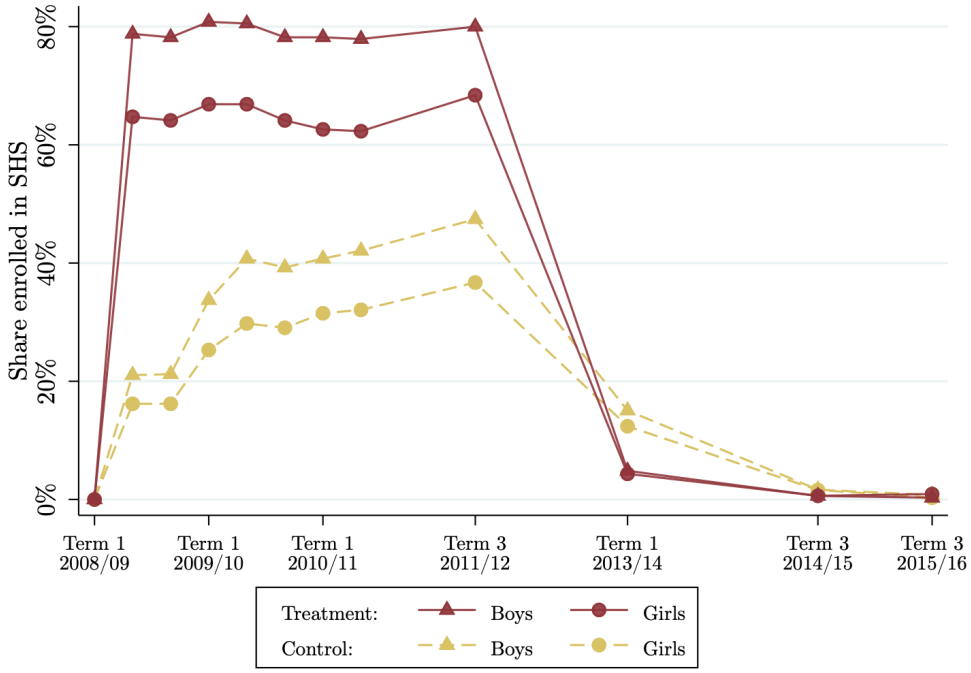
4.1 Secondary Education

We estimate the impact of the scholarship on educational attainment using regressions similar to equation (1). In the specifications reported in the text, we include regional fixed effects, and

[14]There is however a large literature on conditional cash transfer, which speaks to how secondary education participation responds to indirect costs and incentives. Barrera-Osorio et al. (2007) find that fee reductions increased primary enrollment but find no effect on secondary enrollment. Angrist et al. (2006) find that vouchers for private secondary school increased completion rates. Barrera-Osorio et al. (2011) find effects of CCTs on secondary enrollment. Khandker et al. (2003) find that a stipend for secondary education increased enrollment among girls but had no effect among boys. Blimpo et al. (2019) find that secondary school fees elimination increased girls enrollment by 55%.

control for the BECE exam score, though all our results are robust to the inclusion of additional baseline controls. The main results are presented in Figure 2 and Table 2.

Figure 2: Impact of scholarship on SHS enrollment over time



Notes: Data from yearly phone surveys. The scholarships were awarded at the beginning of Term 2 of the 2008/2009 academic year.

Seventy-five percent of scholarship winners enrolled in senior high school immediately upon learning about the scholarship, almost four times the enrollment rate in the comparison group (Figure 2). By 2017, 72.6% of the scholarship winners had completed SHS, compared to 44.6% of the non-winners (Table 2). Thus, while many of those in the control group were eventually able to enroll, scholarships generated a large gap in educational attainment between winners and non-winners.

While the scholarship increased attendance in SHS, it led to a small reduction in attendance in technical and vocational institutes (TVI). In the comparison group, 3.1% completed TVI as of the 2019 survey while in the treatment group, only 0.6% had done so (Table 2, column 5).

The scholarship increased the SHS completion rate (the fraction of the entire group—including those that do not enroll—who graduate from SHS) from 39.8% to 67.2% among women (+69%) and from 49.7% to 77.9% among men (+57%).[15] Figure A1 shows that the effect of scholarships

[15]The lower absolute level of completion rate among women is primarily driven by the fact that about 28% of

on SHS completion is large at all levels of the initial test score distribution. The graduation rate (the fraction of those ever enrolled who graduate from SHS) is extremely high: 98% of scholarship recipients who enroll graduate, compared to 95% of those in the comparison group, with no meaningful difference by gender.[16]

Overall, by 2022, the scholarship had led to a 1.26 years increase in total years of education on average (Table 2).

4.2 Who are the marginal students?

What are the characteristics of students whose SHS completion outcome is changed by the scholarship (the marginal students, or "compliers" in the treatment group)? Table A4 compares baseline characteristics of SHS graduates in the treatment group to those of "always takers". SHS graduates in the treatment group include a mix of "always takers" and compliers. If we see systematic differences with the characteristics of "always-takers" in the control group, they must be driven by compliers. We regress baseline characteristics on a treatment dummy, within the subset of students who graduated from SHS as of 2017. We find surprisingly few differences between the two groups. This suggests that targeting scholarships based on need using a proxy-means test could be very difficult.

4.3 Learning

Some have expressed concern about whether increases in access to education will lead to increases in learning, given the quality of schools (Pritchett, 2001). Knowledge and education are correlated in non-experimental data, but this may reflect the correlation between existing skills and enrollment. In this section, we document significant improvement in cognitive skills.

Impacts on cognitive skills are presented in column 2 of Table 2. These results are based on oral tests administered as part of the 2013 in-person survey. Thus, these tests measure the effect after most study participants had completed or stopped going to senior high school but before participants had a chance to enroll in tertiary education.

the women in the sample had completed junior high school one year prior to the study onset (they passed the BECE exam in June 2007) and had been out of school for 1.5 years by the time they received the scholarship offer. Among those, take-up of the scholarship was significantly lower, at 56%, compared to 72% among women who had graduated in June 2008 and 79% among men who had graduate in June 2008.

[16]For this calculation, we use information on whether students had ever enrolled in SHS as of 2017.

In the full sample, scholarship winners score 0.157 standard deviations higher (we see gains both in math and in reading, see Table A5). This effect is quite large, given that about half of the control group also graduated secondary school. The learning gains for *compliers* is thus likely quite substantial. The point estimates are larger for females (0.194) than for males (0.113), although the difference is not statistically significant. Note that there are very large differences in scores by gender in the control group, with men (who have 0.5 more year of education on average) vastly outperforming women. Thus, despite very large gains, female scholarship winners are barely on par with male non-winners and far behind male winners in learning outcomes.

4.4 Fiscal Cost of Free Secondary Education

Using the responsiveness of secondary school participation to school fees, we can estimate the fiscal cost per additional year of enrollment from making secondary education free. Given the findings above, and the distribution of junior high school exit exam scores, we estimate that in the absence of incentive effects on primary school students, making secondary education free could require paying for seven years of secondary school for every additional year of education generated by marginal students. To see the logic, note that on average, scholarship winners spent 3.11 years in senior high school, while non-scholarship winners spent 1.85 years in senior high school, a difference of 1.26 years. Therefore, within our sample, the scholarship paid for 3.08 years of education for each 1.26 additional years of education. With a few assumptions, we can estimate the effect of a nationwide free senior high school policy using these results. We assume that 60% of qualified students enroll in senior high school by the beginning of Term 2,[17] and assume that they would graduate absent free secondary education. We assume that the 40% of qualified students who do not enroll by the beginning of Term 2 behave like our sample (i.e. they obtain on average 1.85 years of secondary education without financial help and 3.11 years when it is free). With these assumptions, universal free SHS education would require paying for $0.6 \times 4 + 0.4 \times 3.11 = 3.6$ years per student, using the old standard of 4 years, but this would generate only $0.4 \times (3.11 - 1.85) = 0.5$ additional years of secondary education. Therefore, a free senior high school policy would pay the cost of 7.2 years of education for each additional year of schooling attained and the fiscal cost per

[17] Ajayi et al. (2020) find that 44% enroll in the first 6 weeks, and our own sampling data show that 8% (182/2246) of those who have not enrolled in the first 6 weeks enroll by the beginning of Term 2. This yields 0.44+0.66*0.08=48% enrollment rate by the beginning of Term 2. Ajayi et al. (2020) find that 70% have enrolled by the end of Term 2. To be conservative, we use 60%, roughly the midpoint between these two estimates.

additional secondary school graduate would be approximately $3,570.[18]

Note, however, that the promise of free secondary school for students who pass the junior high school finishing exam may also incentivize more financially constrained students to study harder in earlier stages of education, allowing more of them to pass the exam and qualify for senior high school (for some evidence of such incentive effects, see Kremer et al. (2009) at the upper primary level in Kenya, and Lajaaj et al. (2018) at the tertiary level in Colombia.) In Ghana, this is likely an important margin, since as of 2014 only about 40% of those who start junior high school passed the finishing exam.[19]

Targeting scholarships to students with characteristics that predict lower senior high school enrollment conditional on qualifying based on merit (such as students with lower incomes and female students) could increase the ratio of marginal to infra-marginal expenditure and reduce any regressive effects of scholarships for senior high school, though as shown in subsection 4.2, there are few predictors observable to the econometrician, thus presumably even fewer for the government.

5 Post-Secondary Outcomes: The Waiting Game

5.1 Tertiary Education

When they graduated from secondary school, almost all secondary school graduates (over 90% for both women and men) intended to apply to a tertiary program. And over the period of our study, many of them did, often several years after they graduated. Table 3 and Figure A2 show the share of the students that have ever applied to a tertiary program, which increases continuously over time. By 2022, 37% of men and 25% of women in the control group had applied. The treatment effects are +11.5 percentage points for men and +20 percentage points for women.

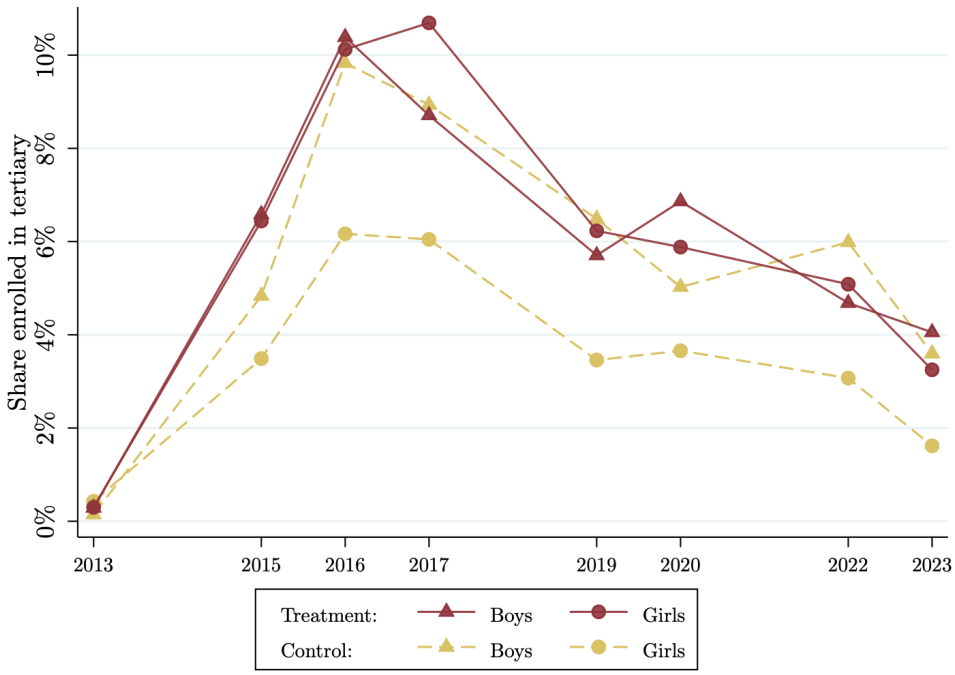
Not all of them succeed. As of 2022, 20% of the control group had ever been admitted and 17% had ever enrolled in tertiary education (Table 4). As of 2023, 13% of the control group graduated from a tertiary program (Table 4). The treatment effect of the scholarship was an

[18] Current estimated cost of a 3-year scholarship ($400) divided by expected additional graduates from one scholarship (which is the estimated treatment effect of a 28 percentage points increase in graduates multiplied by 40% of qualified students who do not enroll on their own by the beginning of Term 2).

[19] If one assumes that the promise of free secondary education would lead one quarter of students who currently do not pass the primary school leaving exam to pass, the ratio of years of education paid for to marginal years of education would fall from 7.2 to 3.6, and the fiscal cost per extra graduate falls to $1,985.

increase of 10.3 percentage points (50%) in admission probability (Table 3), and 7.3 percentage points (43%) increase in actual enrollment (Table 4). As of 2023, the treatment group was 6.6 percentage points (50%) more likely to have completed tertiary. By 2023, only 3.7% of scholarship winners were still enrolled in a tertiary program, but that is no more significantly higher than the rate for non-winners (see Figure 3).

Figure 3: Impact of scholarship on tertiary enrollment over time



The average tertiary enrollment results conceal important heterogeneity by gender. Treatment effects on tertiary education are concentrated among women. By 2023, female scholarship winners are 13.8 percentage points more likely to have ever enrolled in a tertiary institution on a base of 14.3%, and 10.8 percentage points more likely to have completed tertiary on a base of 11.8%, while the effects on men are small and insignificant. The effects could be interpreted as indicating that young men who were likely to be able to eventually enroll in tertiary school were already likely to attend secondary school without the scholarship but that many young women who would have made it to tertiary education were only able to attend secondary school due to the scholarship.

While we see significant impacts of the secondary school scholarship on tertiary enrollment and effects are substantial relative to the low base rates, they concern only about a quarter of the sample. This contrasts with the sample's baseline expectations as well as their post-secondary aspirations. By 2019, six years after graduation, plans to go to tertiary were still alive and well,

however, with 37% of the control group (59% of those who have a secondary school degree) and 52% of the treatment group (64% of those who have a secondary school degree) still planning to apply to tertiary (Table 3). The majority of those who declare still planning to apply to tertiary reside with their parents and report studying to better their application, rather than working. (Table A6 shows treatment effect estimates for additional outcomes on tertiary education plans.) This suggests that over-optimistic expectations of admission into tertiary may distort investments to acquire labor market experience—a point we return to in the next subsection.

Treatment estimates suggest that marginal males (compliers) struggle to move from senior high school completion to tertiary enrollment relative to inframarginal males who could finish senior high school without a scholarship (*always-takers*). Assuming that the treatment effect on tertiary enrollment is due entirely to marginal students, only 5% (0.015/0.282) of young men induced to complete secondary school by the scholarship went on to tertiary education compared to 42% (0.208/0.497) of inframarginal men.

For inframarginal women, the fraction of SHS graduates who eventually enroll in tertiary is 32% (0.143/0.398). Assuming that the treatment effect on tertiary enrollment is due entirely to marginal students, 50% (0.138/0.274) of the young women induced to complete SHS by the scholarship went on to tertiary education. It is possible, however, that part of the effect is due to women who would have completed SHS even absent the scholarship, but would not have afforded tertiary—i.e., the scholarship allowed their family to save on SHS fees and invest in tertiary instead. Indeed, as discussed in subsection 3.3, the scholarship was a wealth transfer to inframarginal families who would have paid for senior high school in the absence of the scholarship. It is worth noting, however, that the wealth-tertiary education gradient is very modest (Figure A3a), possibly owing to the fact that some of the most popular tertiary programs are subsidized (teaching and nursing colleges). In contrast, the secondary school entrance exam score (BECE) seems highly predictive of tertiary enrollment (Figure A3b), consistent with the idea that tertiary admissions are merit-based.

In Section 6, we present a model that is consistent with the findings that inframarginal men are somewhat more likely to progress to tertiary than inframarginal women, that marginal men are unlikely to make it to tertiary education, and that marginal women perform much better than marginal men and possibly as well as inframarginal women. The model also highlights how expectations over admission into tertiary may dampen incentives to join the labor market.

5.2 Labor Market

This section discusses labor market impacts. The long-run follow-up is critical to capture the long waiting period between graduation from secondary school, application to tertiary programs, and tertiary school.[20] Indeed, throughout most of our labor market survey period (2015-2023), there is entry to and exit from tertiary education as just discussed. Both are significantly more likely in the treatment group because graduation from secondary school is more likely in this group. Year 2019 is our last normal, low-attrition (6%) year. The year 2020 allows us to shed light on the impact of secondary education on resilience during the pandemic. Years 2022 and 2023 are back to normal but attrition is somewhat higher (19% and 22% respectively), though still relatively modest given that these are the 14th and 15th year follow-ups.

5.2.1 Labor market trajectories

Figure A4a shows that the rates of regularly working for pay are low, and progress slowly, both in the treatment and in the control group. In 2013, at the time when students should have graduated from secondary school, about 33% of women and 55% of men have earned anything in the past month. The number increases steadily over the study period to reach 60% of women and 76% of men in 2023, with similar shares in the treatment and in the control group. The share working is higher when looking at whether study participants worked at any point in the past 6 months, but is starting from only 63% for women and 85% for men in 2013, increasing over the study period.

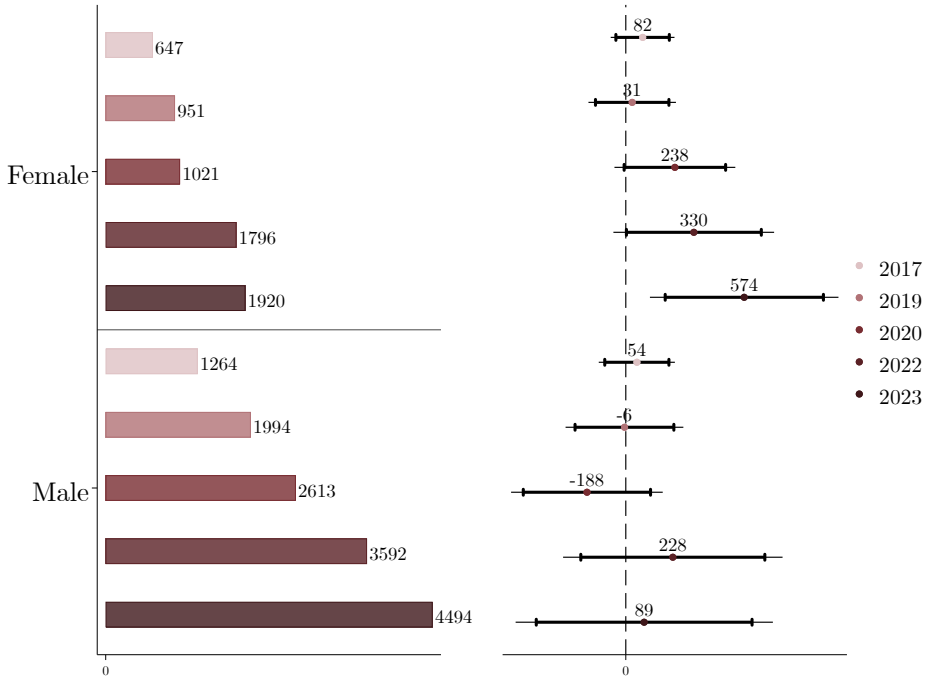
The impacts of the scholarship on labor outcomes in 2019 and 2023 are presented in Table 5. While, as was already apparent from the figures, we see no impact on labor force participation (having worked for pay in the past 6 months), the type of employment differs between treatment and control groups. Scholarship winners are 3.9 percentage points more likely to be a salaried employee with a contract (p-value 0.008), a relatively rare outcome overall (8.4% in the control group). Self-employment is lower among scholarship winners.

Winning a scholarship substantially increases the chance a woman eventually obtains a public sector job, but consistent with the tertiary education results, it does not do so for men. Looking at the control group, 0.067/0.398 or 17 percent of inframarginal women obtain public sector jobs. By 2023, female scholarship winners were 6.7 percentage points more likely to be public

[20] All graduates of Ghanaian tertiary institutions are required to serve one year in the National Service. In the National Service, the graduate will work (usually for the government, but occasionally for a private company) for a year and receive a monthly stipend from the government.

sector employees. This implies that 24% (0.067/0.274) of marginal women ended up getting a public sector job, more than among inframarginal women. In contrast, while 22% (0.108/0.497) of inframarginal men obtain public sector jobs, there is no significant effect of the scholarship on men obtaining public sector jobs, which means that we cannot reject the hypothesis that none of the marginal men obtained a public sector job.

Figure 4: Total Earnings in Past 6 Months: Treatment Effects over Time



Notes: Earnings winsorized at the 99th percentile. For each panel: left half of graph shows means in comparison group; right half shows estimated treatment effects, with confidence intervals of 90% indicated by whiskers and 95% indicated by the ends of the line.

5.2.2 Earnings

Figure 4 shows the estimates of the total impact on earnings over time. The treatment effect on women's earnings is systematically positive, but it only becomes significant at the 10% level in 2020 and at the 5% level in 2023.[21] The increase ranges from 20 to 30% across the period 2020-2023. This is still far from the return to secondary high school as perceived by parents

[21] This is consistent with Figure A4b, which shows a steady increase in the probability that they have a public sector job, and with Figure A5 that shows that by the end of the period, a woman with a public sector job earns about 3 times as much as one who is working, but not in the public sector.

at baseline. However, given the large standard errors, the confidence intervals encompass the Mincerian returns observed in the control group and the ranges found in other studies in low-income contexts (typically ranging from 7 to 10%, see Psacharopoulos and Patrinos (2018)).

For men, the results on earnings are much lower and not systematically positive. The confidence intervals are large however, which means we cannot reject that returns are either negative, zero or high compared to standard estimates of Mincerian returns.

There are several reasons for the imprecision in the earnings measures. A quarter of our sample is self-employed and hence their income is subject to stochastic shocks and seasonal fluctuation. Moreover, self-employment income is particularly subject to measurement error (de Mel et al., 2009). Finally, income is highly skewed.

Figure A6a shows the relationship between earnings and baseline performance, by treatment status. For both males and females, the scholarship increases the correlation between baseline performance and earnings, but this is entirely driven by the extensive margin effect (those with a higher score are more likely to complete SHS as seen in Figure A1). Among SHS graduates, the relationship between BECE scores and earnings is the same for treatment and control groups. Interestingly, there appears to be no labor market returns to skills (as measured by the BECE) among those who do not complete SHS in the control group (Figure A6b).

Note that our estimated returns, while already fairly long-run, may underestimate longer-run returns for two reasons. First, we still see a small difference in educational enrollment between scholarship winners and non-winners among women, with twice as many scholarship winners still enrolled in tertiary at the time of our last follow-up, though the gap is small in magnitude and not significant (see Table 4). Second, if education and experience are complementary (e.g. Yamauchi (2004)), effects on lifetime income will exceed medium-run effects.

5.2.3 Job search

A striking result, shown in Table 6, is that among those who have a job, scholarship winners were much less satisfied with it as of 2019: there is a negative treatment effect of -0.195 on a scale that ranges from 1 to 5 (p-value=0.01). While, by then, scholarship winners were not more confident they could get a better job (column 2), they were significantly more likely than non-winners to be actively looking for a job (columns 3 and 4), whether or not they were currently employed, suggesting that they maintained higher aspirations (Table 6).

Recall that the study sample was drawn from rural areas. One way for a secondary school graduate to search for a job could be to migrate to an urban area. When asked in 2023 whether they had ever attempted to relocate to a big city to look for a job, close to 30% of females and over 40% of males in the control group said they had (column 5 of Table 6). These attempts often fail, however. As of 2023, the share still living in a big city is only 13% for both genders (column 6 of Table 6), and we see no difference across treatment arms. Yet we see a large treatment effect on attempted migration for men: male scholarship winners are 11 percentage points (around 20%) more likely to report they ever went to a city to look for a job. It seems that these attempts were all unsuccessful however. Could it be because marginal men, who come from poorer families, lack the network connections to succeed in finding a job? Column 7 of Table 6 shows that close to a third of male SHS graduates rely on networks to help secure a job—and this is not differential by treatment status, suggesting that lack of network may not be a primary source of the struggle scholarship recipients face in searching for a job in urban areas.

5.2.4 COVID resilience

Table A7 presents labor market results from the 2020 survey round. This round was done between May and September 2020. We control for the specific time at which the survey was done for this analysis, since the survey was spread over three months and the COVID-19 situation was evolving rapidly, with restrictions easing over time.[22] While self-employment increased by 10 percentage points in the control group between 2019 and 2020, both female and male scholarship winners saw a smaller increase, and as a result scholarship winners are 6.6 percentage points (-19%) less likely to be self-employed in 2020 (p-value 0.004).

Besides this, the treatment effects for men and women scholarship winners seem to have taken very different turns during these times. Among men, we do not see significant differences between scholarship winners and losers in the probability of having a job with benefits or with a contract. In fact, total earnings in the first half of 2020 are smaller (though not significantly) for scholarship winners. In contrast, among women, scholarship winners do much better than scholarship non-

[22]The government of Ghana adopted strict measures in response to COVID-19 on March 15, closing schools, banning all social gatherings, and closing international borders. A 3-week lockdown restricted the activities and movements of people in the urban areas of Greater Accra and Kumasi for most of April 2020. Social distancing and regular disinfection protocols were put in place in markets. By end of July, Ghana's Trades Union Congress (TUC) estimated that 100,000 jobs had been lost in the formal sector and 400,000 in the informal sector(https://www.theghanareport.com/covid-19-has-rendered-500000-people-jobless-in-ghana-tuc/. Schools did not re-open until January 2021.

winners. We detect large and marginally significant differences in earnings, with women in the treatment group reporting 24% higher earnings (p-value 0.098) over the past 6 months. Looking at the data month by month, we see a particularly large gap in earnings in April, the month most affected by the introduction of severe COVID-19 related restrictions.[23]

5.3 Aspirations or Frustration

While substantial in percentage terms, the increase in tertiary education and in obtaining public sector jobs due to the scholarship was much lower than parents or children anticipated at baseline. In fact, we cannot reject that it was null for males. Returns to education in this context seem to fall far short of perceived returns to education. This suggests that the finding in Jensen (2010) that eighth-grade boys in the Dominican Republic underestimate the returns to secondary school is not general. Rather, our results confirm a recent literature showing over-optimism on the continent: Banerjee and Sequeira (2023) in South Africa, Bandiera et al. (2023) in Uganda, and Abebe et al. (2023) in Ethiopia.

Given that, the question is whether the program generated disappointment and frustration in the years that followed secondary school graduation, especially for males. This does not appear to be true on average, although the evidence does not point towards a large positive effect of education on mental health and well-being either: a satisfaction index (covering life satisfaction, financial satisfaction and a comparison of their life to others) shows a small insignificant negative treatment effect, as does a mental health index (Table 7).

Study participants' expectations for the job their children can attain if they reach primary school, however, are much more realistic than their own expectation when they graduated (see Table A8). We see no difference between the treatment and control groups, suggesting that society as a whole has revised downwards their expectations, likely due to the fact that there are now many more (unemployed) graduates around.[24]

[23] There is a 35% increase in March and a 55% increase in earnings in April (with a p-value of 0.008). By May, the employment and earnings of the control women have recovered and the treatment effects are smaller.

[24] By 2022, three cohorts of students had possibly completed SHS under the free SHS policy put in place by the Ghanaian government in 2017.

6 Model

We present a simple model motivated by these findings, building on Harris and Todaro's classic model of a dual labor market.[25] The main goal of the model is not to explain our findings, but to help think through what may happen under a different policy scenario. In particular, we consider the case where free secondary education is offered to all (as in the 2017 Ghana policy), and a hypothetical reform of the admissions process for tertiary education.

6.1 Set up

The model has three periods.

1. In period 1, parents choose whether to enroll their children in secondary school. Each family has two children. The decisions are made under a credit constraint at the family level (family h cannot borrow above some amount K_h, potentially heterogeneous). If a child attends secondary school, they earn nothing and pay fee F. If they don't enroll in secondary school, they join the private labor market and earn the market wage w_1^u.

2. In period 2, youth who have not gone to secondary school continue working and earn the market wage w_2^u. Youth who have enrolled in secondary school face a new choice: enroll in a lottery for a tertiary education program (leading to a job in government), or start to work, earning w_2. Reflecting the drawn out process of tertiary applications, we assume that a youth applying for the tertiary lottery has to remain unemployed or earn subsistence wage (normalized to zero) throughout period 2 if they don't get admitted. If they enroll in tertiary, they also earn 0. For youth i in family f, the probability of admission $\beta_{i,f}$ depends on the youth underlying ability, as well as the number of people who applied. For girls, another period 2 choice is to leave the labor force completely (to take care of children) and earn 0. We assume that a proportion $1-\alpha$ of girls make that choice in period 2 (for boys $\alpha = 1$). Consistent with our data showing that labor force participation at age 25 is not correlated with middle school exit scores (Figure A7), we assume that α is independent of ability, and families do not know in period 1 if a girl will decide (or have) to leave the labor force.

[25] See also Rankin et al. (2010) for an adaptation of the Harris Todaro model to African labor markets.

3. In period 3, youth who have not gone to secondary school earn w_3^u. Youth who have gone to secondary but not tertiary work and earn the market wage w_3. Youth with tertiary education earn the public sector wage $\overline{w_P}$ which is fixed (rather than determined by market forces). Girls who have gone out of the labor force in period 2 stay out of the labor force.

We assume risk neutrality and, for simplicity of notation, no discounting between periods.

6.2 Solution

We solve the problem backwards, starting in period 2, for youth who have graduated from secondary school. A youth who is in the labor force will be indifferent between entering the tertiary lottery and not entering the lottery if

$$w_2 + w_3 = 0 + \beta_{i,f}\overline{w_P} + (1 - \beta_{i,f})w_3 \tag{2}$$

or:

$$w_2 + \beta_{i,f}w_3 = \beta_{i,f}\overline{w_P} \tag{3}$$

Call N_P the number of slots in tertiary and N_s the number of secondary school graduates for a given cohort. Then on average, the chance to be admitted in tertiary is $\beta = N_P/N_s$. Equilibrium is achieved if $w_2 + (N_P/N_s)w_3 = (N_P/N_s)\overline{w_P}$. The equilibrium is shown in Figure 5a.

At the individual level, there exists a threshold $\underline{\beta}$, under which the youth does not enter the lottery. $\underline{\beta}$ could be quite low if the wages in the public sector are very high. It is rational for youth to accept unemployment in period 2, even with a very low probability of success, if the gains to be realized in period 3 are sufficiently large.

In period 1, absent credit constraints, parents will decide to send a child to secondary school even if they anticipate that they would not choose the lottery in period 2 if:

$$\alpha(w_2 + w_3) > w_1^u + \alpha(w_2^u + w_3^u) + F \tag{4}$$

For simplicity, assume that with $F > 0$, the returns to education in the private market are such that Equation 4 is never true. Therefore, youth who anticipate not participating in the lottery will not attend secondary school if they have to pay for it.

Denote $\tilde{\beta_{i,f}}$ the anticipated odds of tertiary admission for child i in family f, viewed from

period 1 (we will discuss the different possibilities for $\tilde{\beta_{i,f}}$ below).

If the family is not credit constrained, the choice is to pay the secondary school fee for child i if the child anticipates participating in the lottery and if:

$$\alpha[(1-\tilde{\beta_{i,f}})(\tilde{w_2}+\tilde{w_3})+\tilde{\beta_{i,f}}\overline{w_P}] > +w_1^u+\alpha(w_2^u+w_3^u)+F \tag{5}$$

where the tilde above some quantities reflect anticipated wages that are the results of the decision taken in equilibrium.

Equation 5 defines a threshold $\underline{\underline{\tilde{\beta}}}$ below which the parent will decide not to pay the fee (thus not to send a child to secondary school). Observe that if $\tilde{\beta_{i,f}} > \underline{\underline{\tilde{\beta}}}$, it will mechanically satisfy the lottery participation constraint $\tilde{\beta_{i,f}} > \underline{\beta}$. Inspection of Equation 5 suggests that $\underline{\underline{\tilde{\beta}}}$ is increasing in F and w_1^u (the opportunity cost), and decreasing in α (the probability to stay in the labor force).

Finally, this choice may not be available to all families. In particular: if $K_f < F$ the family is credit constrained and no child goes to school. If $F < K_f < 2F$ the family is credit constrained and only one child may go to school. And if $K_f > 2F$ both children can go to school.

6.3 Analysis

6.3.1 Partial equilibrium: individual scholarships

This simple model gives us a number of insights.

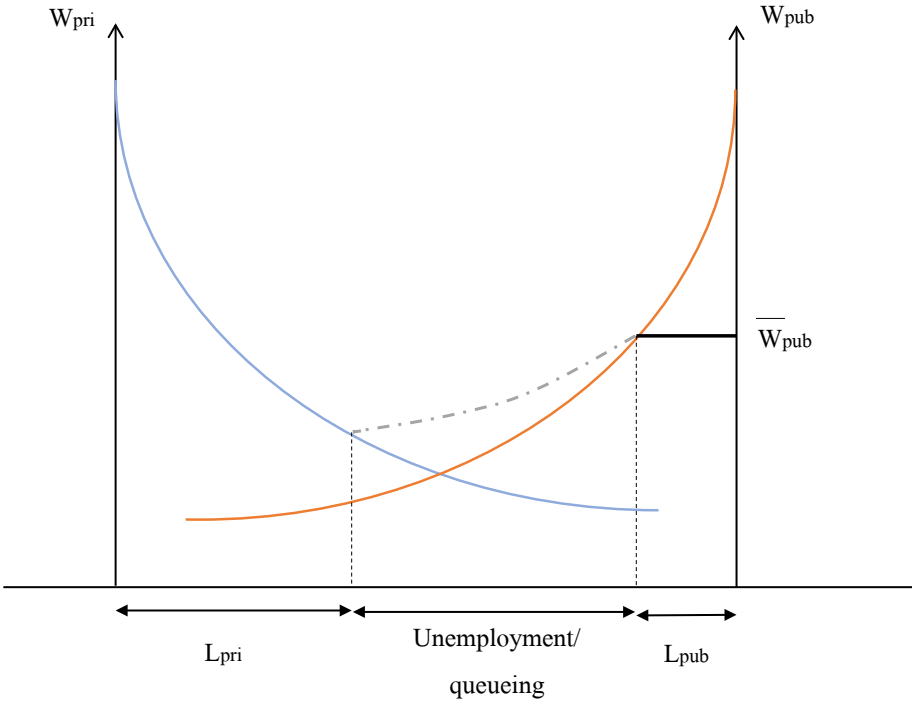
First, even without credit constraints, parents will require a higher lottery threshold to send girls to school. This is because a number of them, regardless of their inherent ability (which conditions the probability to be admitted in tertiary), will drop out of the labor force, and the secondary school fee (plus the opportunity cost of not working in period 1) will be wasted.

Second, for families with one boy and one girl who are partially credit constrained, and who can afford sending only one child to school, there is a range of abilities of boys and girls such that higher ability girls will be kept out of school while lower ability boys will be sent to school. This is because if the family must make a choice, the average gain of sending a boy will be greater.

Third, when, as in our experiment, fees are sent to zero for a small number of children, none of the equilibrium quantities are affected by the treatment. Thus, the only thing that changes is that F goes to zero, for some families. The ability threshold for sending a child to school will go down, but will remain higher for girls given their lower market participation in period 2 and 3.

Figure 5: Model: Dual Labor Market

(a) Without Subsidies for Secondary Education



(b) With Subsidies for Secondary Education

Notes: The dot-dash line corresponds to *expected* wage in the public sector.

Fourth, with credit constraints, we could see some high ability boys, who were previously unable to pay the fee but would have wanted to, attend school (boys from families who are most credit constrained: $K_f < F$). But potentially many more high ability girls will be impacted (girls from both $K_f < F$ and $K_f < 2F$ families). If credit constraints and ability are independent, and the majority of families are credit constrained (as is the case in our sample given the sampling strategy) but still able to pay for at least one child, then it is possible that marginal girls are higher ability on average than inframarginal girls. But the opposite will be true for boys.

Fifth, with zero fees for secondary education, the private returns to education may be enough to justify sending all boys to secondary school, even those who know they will not participate in the lottery for tertiary education. In that case, we should see a lower rate of applications to tertiary school among marginal boys, compared to inframarginal boys. However, for girls, if the probability to stay in the labor force (α) is low enough that secondary education is not worth its opportunity cost for girls who will not participate in the tertiary education lottery, we should see a lower impact of introducing zero fee education on take-up of secondary education. However, marginal girls may have as high a tertiary application rate as inframarginal girls.

While the model is not designed to be the only explanation for our results, it is consistent with some of the patterns we observe. In particular, it is consistent with the fact that the marginal boys are less likely to be admitted to tertiary programs than the inframarginal boys, even as that is not the case for the marginal girls. This suggests that marginal boys are lower ability than infra-marginal boys but that this is not the case for marginal girls. It is also consistent with the protracted entry in the labor market for secondary school graduates, the repeated attempts to gain entry into tertiary school, and the fact that even those who are working are dissatisfied with their jobs: in general, they are the ones who have lost the (tertiary / public sector) lottery. We don't see them particularly bitter, which is consistent with a model where they make a rational choice to try as much as they can, even with low chances of success. We don't see a decline in marginal students' applications to tertiary school, suggesting that they continue to be drawn to tertiary mainly by the prospect of public sector job. This is true for both genders.

6.3.2 Market equilibrium: free secondary school

While our experiment happened in partial equilibrium, we can use the model to analyze what may happen if fees were removed for everyone. We can see in Figure 5b that an increase in the number

of educated youth without a change in the public sector wage will push the educated wages w_2 and w_3 down, and lead to increases in unemployment in period 2.

To anticipate the full impact of free secondary school for everyone, we need to specify a model for parental expectations: do they have rational expectations (and thus anticipate the decrease in the probability of success) or do they use the current probability of success to form their anticipation? A reasonable model could be that, in the short term, parents and youth do not take into account everyone else's response and decide on secondary enrollment assuming large probability of success. Thus, they would still assume the very high probability of obtaining a government job that we found in our baseline survey. In that case, we would see a very large rush to secondary school, followed by a bulge in unemployment or underemployment after that cohort graduates. Note that even if once they graduate, the youth are fully realistic about their probability of success, it would still be worth it to continue applying. The impact on entry into tertiary education would be particularly negative for boys, because free secondary education would draw in a large number of talented girls who have higher rate of success than the marginal boys.

While our experiment was a partial equilibrium intervention, the fact that the youth in our panel graduated as part of a double cohort (due to the change of school calendar), combined with the freezing of hiring of civil servants and tertiary programs, created a surprise decrease in the probability of success that is probably similar to what we would see if free education had been made free for all and expectations had been adaptative. This may explain why the rate of success for marginal boys is not only lower than that of inframarginal boys, but appears to go all the way down to zero on average. This may also be the source of the very low Mincerian returns we observe (comparing earnings of secondary school graduates and others): the large influx of graduates leads to an increase in the unemployment of educated workers and a decrease in the market wages, both of which leads to lower average earnings.

Over time, however, expectations would adapt. Indeed, in our survey of youth, their expectation of whether their children could get a government job if they complete SHS is in line with the current reality (now that secondary education is free for all). Thus, after a few years, we would see lower enrollment in secondary school and lower unemployment of educated youth than in the first few years (but still more enrollment and more unemployment of secondary school graduates than when secondary education involved fees).

If the returns to education in the private market were sufficiently high to justify enrollment

in secondary school even for those who did not plan to enroll in the tertiary lottery, we would continue to see a high secondary enrollment rate, but less secondary unemployment.

6.3.3 Alternative policies

In this highly stylized model, free secondary school for all is not a good policy: it creates a glut of secondary school graduates who crowd each other out and do not work for a long period of time. New graduates do not benefit much on average, and create negative externalities on those who would have graduated. The aggregate impact of having a large cohort of young people underemployed for long periods may well be greater than the direct productivity gains of educating them better. Loans for families who are credit constrained would be more appropriate.

However, the problem does not come from secondary school *per se* but from the fact that the government sector constitutes a very attractive sector with a fixed wage, which is worth waiting for. Moreover, secondary school has benefits that are not captured by the model, especially for girls: we show in Duflo et al. (2024) that children of female scholarship recipients have higher survival rates and higher cognitive test scores. So a policy maker may want to continue subsidizing secondary school.

In that case (assuming the rents in the government sector cannot be lowered), efficiency could be improved by offering secondary school students exactly one shot to apply for tertiary programs that are qualifying for government positions through competitive examinations, while they are still attending secondary school.[26] At a minimum, the window to apply should be much shorter.

7 Conclusion

Using a randomized controlled trial in which a random subset of qualified but financially constrained students in rural Ghana were awarded secondary school scholarships and detailed outcomes data collected over 15 years, we identify the partial equilibrium impact of free education on those who obtain education in response to the scholarship. We find that scholarships increase secondary school completion rates by 28 percentage points. Furthermore, we find that secondary education does impart significant learning gains.

[26] Somewhat bizarrely, the current system does exactly the opposite, since secondary school students must wait a year before even enrolling.

The scholarship also led to an increase in the fraction of youth who ever enrolled in tertiary education from 14% to 28%. Those gains are entirely driven by women who are otherwise less likely to access secondary school, likely reflecting unequal treatment by gender within the household in some families.

While scholarships increased the probability of tertiary education and obtaining a public sector job for women, the overall fraction of secondary school graduates attending tertiary education remains fairly low in this sample. Few secondary school graduates have met their ambition of becoming teachers or entering other occupations requiring tertiary education and commanding high rents. To the extent that government jobs are in fixed supply, there will likely be excessive number of people competing for these jobs since each new entry creates a negative externality for other applicants. A symptom of this competition is that, in 2013, 67% of the treatment group (almost all of those who graduated from secondary school) had plans to attend tertiary; but as of 2023 just about a third of them (29%) had been able to carry those plans out. Those who did enroll often spent several years waiting for a place.

Up to 2019, there is no evidence that the scholarship for free secondary education led to large improvements in earnings. We start seeing significant positive earnings impacts for female scholarship winners from 2020 onwards. The earnings gains may increase over time as more of those who have gone to tertiary school graduate and enter the labor market, and more give up on tertiary school and start acquiring meaningful experience in the labor market.

Nevertheless, it appears plausible at this stage that any private labor market gains from education are to a significant extent at the expense of others (if education mainly help graduates get access to a rationed job). Moreover, the slow entry of secondary school graduates in the labor market reflects in part their long wait for the opportunity to get one of these slots. They do not seem to commit to an alternative occupation as long as they think they still have a chance to get a tertiary slot, which deprives them of some of the benefits of education and may lead to depreciation of human capital (Dinerstein et al., 2020).

The policy may have had many positive social returns outside the labor market sector, including positive intergenerational impacts on health and cognitive development as shown in Duflo et al. (2024), so the labor market results should not be considered in isolation by decision-makers.

A policy of universal free secondary school could be accompanied with a reform of public sector compensation and hiring policies, in order to reduce the distortions caused by the hope of getting

access to scarce jobs with large rents. Entry to training programs could be restricted to one or two years after secondary school graduation.

If such a reform is not possible, one potential alternative to universal free education would be more targeted support which maximizes the human capital gains of secondary education while limiting the distortions driven by the competition for scarce jobs. For example, scholarships could be offered to students from disadvantaged backgrounds with high scores on the junior high school exit exam. Most obviously, scholarships could be given in priority to girls. Both the model and data suggest that many girls with the potential to succeed will not go to senior high school without scholarships.

References

Abebe, Girum, Stefano Caria, Marcel Fafchamps, Paolo Falco, Simon Franklin, Simon Quinn, and Forhad Shilpi, "Matching Frictions and Distorted Beliefs: Evidence from a Job Fair Experiment," 2023. Working paper.

Ajayi, Kehinde F, "School Choice and Educational Mobility: Lessons from Secondary School Applications in Ghana," Technical Report, IED Discussion Paper 259 2013.

_ , Willa H Friedman, and Adrienne M Lucas, "When Information is Not Enough: Evidence from a Centralized School Choice System," Technical Report, NBER Working Paper 27887 2020.

Alfonsi, Livia, Mary Namubiru, and Sara Spaziani, "Meet Your Future: Experimental Evidence on the Labor Market Effects of Mentors," Technical Report 2022. Working paper.

Angrist, Joshua, Eric Bettinger, and Michael Kremer, "Long-term educational consequences of secondary school vouchers: Evidence from administrative records in Colombia," *The American Economic Review*, 2006, *96* (3), 847–862.

Aryeetey, Ernest and William Baah-Boateng, "Understanding Ghana's growth success story and job creation challenges," Technical Report 2015.

Baird, Sarah, Joan Hamory Hicks, Edward Miguel, and Michael Kremer, "Worms at Work: Long-run Impacts of Child Health Gains," *Quarterly Journal of Economics*, 2017.

Bandiera, Oriana, Vittorio Bassi, Robin Burgess, Imran Rasul, Munshi Sulaiman, and Anna Vitali, "The Search for Good Jobs: Evidence from a Six-year Field Experiment in Uganda," Technical Report 2023. Working paper.

Banerjee, Abhijit and Sandra Sequeira, "Learning by searching: Spatial mismatches and imperfect information in Southern labor markets," *Journal of Development Economics*, 2023, *164*, 103111.

_ , Esther Duflo, and Garima Sharma, "Long-term Effects of the Targeting the Ultra Poor Program," Technical Report, MIT Working Paper 2020.

Barrera-Osorio, Felipe, Leigh L Linden, and Miguel Urquiola, "The effects of user fee reductions on enrollment: Evidence from a quasi-experiment," Technical Report, Columbia University 2007.

Barton, Nicholas, Tessa Bold, and Justin Sandefur, "Measuring the Rents from Public Employment: Regression Discontinuity Evidence from Kenya," Technical Report, CGD Working Paper 457 2017.

Blattman, Christopher, Nathan Fiala, and Sebastian Martinez, "The Long-Term Impacts of Grants on Poverty: Nine-Year Evidence from Uganda's Youth Opportunities Program," *American Economic Review: Insights*, 2020, *2* (3), 287–304.

Blimpo, Moussa P, Ousman Gajigo, and Todd Pugatch, "Financial Constraints and Girls Secondary Education: Evidence from School Fee Elimination in The Gambia," *The World Bank Economic Review*, 2019, *33* (1), 185–208.

Card, David, "Chapter 30 - The Causal Effect of Education on Earnings," in Orley C. Ashenfelter and David Card, eds., *Orley C. Ashenfelter and David Card, eds.*, Vol. 3 of *Handbook of Labor Economics*, Elsevier, 1999, pp. 1801–1863.

de Mel, Suresh, David J McKenzie, and Christopher Woodruff, "Measuring microenterprise profits: Must we ask how the sausage is made?," *Journal of Development Economics*, 2009, *88* (1), 19–31.

Dinerstein, Michael, Rigissa Megalokonomou, and Constantine Yannelis, "Human Capital Depreciation," Technical Report, University of Chicago, BFI Working Paper No. 2020-146 2020.

Donovan, Kevin, Will Jianyu Lu, and Todd Schoellman, "Labor market dynamics and development," Technical Report, Federal Reserve Bank of Minneapolis, No. 596 2020.

Duflo, Esther, Pascaline Dupas, and Michael Kremer, "Education, HIV, and early fertility: Experimental evidence from Kenya," *American Economic Review*, 2015, *105* (9), 2757–2797.

_ , _ , Liz Spelke, and Mark Walsh, "Intergenerational Impacts of Secondary Education: Experimental Evidence from Ghana," 2024.

Evans, David and Irene Muthoni Ngatia, "School costs, short-run participation, and long-run outcomes: evidence from Kenya," *The World Bank Economic Review*, 2020.

Filmer, Deon and Norbert Schady, "The Medium-Term Effects of Scholarships in a Low-Income Country," *Journal of Human Resources*, 2014, *49* (3), 663–694.

Finan, Frederico, Benjamin A Olken, and Rohini Pande, "The Personnel Economics of the Developing State," in "The Handbook of Field Experiments, Volume II" 2015, pp. 467–514.

Fujimoto, Junichi, David Lagakos, and Mitchell VanVuren, "Aggregate and Distributional Effects of FreeSecondary Schooling in the Developing World," Technical Report, National Bureau of Economic Research 2023.

Gale, D. and L. S. Shapley, "College Admissions and the Stability of Marriage," *The American Mathematical Monthly*, 1962, *69* (1), 9–15.

Gertler, Paul, James Heckman, Rodrigo Pinto, Arianna Zanolini, Christel Vermeersch, Susan Walker, Susan M Chang, and Sally Grantham-Mcgregor, "Labor market returns to an early childhood stimulation intervention in Jamaica," *Science*, 2014, pp. 998–1001.

Hicks, Joan Hamory, Edward Miguel, Michael W Walker, Michael Kremer, and Sarah Baird, "Twenty Year Economic Impacts of Deworming," Technical Report, NBER Working Paper No. w27611 2020.

Jensen, Robert, "The (Perceived) Returns to Education and the Demand for Schooling," *The Quarterly Journal of Economics*, 2010, *125*, 515–548.

Khandker, Shahidur, Mark Pitt, and Nobuhiko Fuwa, "Subsidy to Promote Girls Education: The Female Stipend Program in Bangladesh," Technical Report, MPRA Paper 23688 2003.

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

Lajaaj, Rachid, Andrew Moya, and Fabio Sanchez, "Equality of Opportunity and Human Capital Accumulation: Motivational Effect of a Nationwide Scholarship in Colombia," Technical Report, CEDE Doc 26 2018.

Lang, Kevin, "Ability Bias, Discount Rate Bias, and the Return to Education," 1993. Manuscript.

Osei, Robert, Isaac Osei-Akoto, Ernest Aryeetey, Fred Dzanku, Christopher Udry, and Economic Growth Center, "ISSER-Northwestern-Yale Long Term Ghana Socioeconomic Panel Survey (GSPS)," 2022.

Ozier, Owen, "The impact of secondary schooling in Kenya: A regression discontinuity analysis," *Journal of Human Resources*, 2018, *53* (1), 157–188.

Pritchett, Lant, "Where has all the education gone?," *World Bank Economic Review*, 2001, *15* (3), 367–91.

Psacharopoulos, George and Harry Anthony Patrinos, "Returns to Investment in Education: A Decennial Review of the Global Literature," Technical Report, Policy Research Working Paper; No. 8402. World Bank, Washington, DC 2018.

Rankin, N, J Sandefur, and F Teal, "Learning & earning in Africa: Where are the returns to education high?," Technical Report 2010.

Romano, Joseph P and Michael Wolf, "Exact and Approximate Stepdown Methods for Multiple Hypothesis Testing," *Journal of the American Statistical Association*, 2005, *100* (469), 94–108.

Rosenzweig, Mark and Christopher Udry, "External Validity in a Stochastic World: Evidence from Low-Income Countries," *The Review of Economic Studies*, 2020, *87*, 343–381.

Yamauchi, Futoshi, "Are experience and schooling complementary? Evidence from migrants assimilation in the Bangkok labor market," *Journal of Development Economics*, 2004, *74*, 489–513.

Table 1: Baseline Sample Characteristics and Balance

	(1) Age in 2008	(2) BECE exam performance	(3) No male head in the household	(4) Number of HH members	(5) Highest education of HH head: primary or less	(6) Highest education of HH head: SHS or more	(7) Perceived returns to SHS (%)	(8) Per capita yearly household expenditure
Panel A: All								
Treatment	-0.064	0.002	0.009	-0.096	0.011	0.001	14.639	20.806
	(0.073)	(0.004)	(0.023)	(0.109)	(0.023)	(0.018)	(28.106)	(21.185)
P-value	0.376	0.585	0.706	0.377	0.648	0.977	0.603	0.326
Comparison mean	17.369	0.623	0.425	5.616	0.482	0.171	276.102	503.156
N	2060	1924	2053	2064	2051	2051	1782	2053
Panel B: Female								
Treatment	-0.050	-0.001	-0.030	-0.131	0.020	0.001	33.392	18.770
	(0.100)	(0.005)	(0.033)	(0.145)	(0.033)	(0.025)	(39.913)	(26.830)
P-value	0.620	0.833	0.370	0.368	0.549	0.982	0.403	0.484
Comparison mean	17.314	0.618	0.455	5.578	0.480	0.172	272.429	505.577
N	1033	961	1031	1036	1032	1032	874	1031
Panel C: Male								
Treatment	-0.085	0.005	0.047	-0.061	0.001	0.001	-1.726	23.002
	(0.106)	(0.005)	(0.033)	(0.162)	(0.033)	(0.025)	(39.730)	(32.845)
P-value	0.421	0.361	0.150	0.708	0.985	0.971	0.965	0.484
Comparison mean	17.426	0.628	0.395	5.656	0.484	0.170	279.719	500.659
N	1027	963	1022	1028	1019	1019	908	1022

Notes: Data from baseline survey (2008). We document pre-intervention characteristics for the comparison group ("comparison mean") and differences between treatment and comparison ("Treatment" coefficient). Panel A shows the full sample, Panel B of females, Panel C of males. The estimated difference between the comparison and treatment groups are in each panel's first row; standard errors are in each panel's second row in parentheses; p-values from the test that the respective treatment-comparison difference is non-zero are reported in the third row; control group means are in each panel's fourth row; sample size for the estimation is in each panel's fifth row. Controls include region dummies.

Table 2: Secondary Education Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Total years of education to date (2013)	Total cognitive score (2013)	Completed SHS (2017)	Total years of SHS (2017)	Completed TVI (2017)	Total years of education to date (2022)
Panel A: All						
Treatment	1.191	0.157	0.280	1.265	-0.025	1.326
	(0.077)	(0.046)	(0.022)	(0.079)	(0.006)	(0.115)
P-value	0.000	0.001	0.000	0.000	0.000	0.000
Step-down p-val	0.010	0.010	0.010	0.010	0.010	0.010
Comparison mean	10.787	-0.000	0.446	1.853	0.031	11.425
N	2064	1983	1970	1944	1970	1704
Panel B: Female						
Treatment	1.186	0.194	0.274	1.198	-0.008	1.455
	(0.114)	(0.069)	(0.032)	(0.119)	(0.009)	(0.167)
P-value	0.000	0.005	0.000	0.000	0.336	0.000
Step-down p-val	0.010	0.010	0.010	0.010	0.396	0.010
Comparison mean	10.575	-0.175	0.398	1.651	0.019	11.056
N	1036	1002	997	983	997	860
Panel C: Male						
Treatment	1.183	0.113	0.282	1.310	-0.042	1.178
	(0.101)	(0.059)	(0.030)	(0.103)	(0.009)	(0.156)
P-value	0.000	0.054	0.000	0.000	0.000	0.000
Step-down p-val	0.010	0.099	0.010	0.010	0.010	0.010
Comparison mean	11.006	0.183	0.497	2.066	0.044	11.806
N	1028	981	973	961	973	844
P-val male=fem	0.963	0.371	0.745	0.375	0.004	0.278

Notes: Year of survey in parentheses. Panel A shows results for the full sample, Panel B for females, Panel C for males. The last row shows the p-values for tests that the effects are identical between males and females. "TVI" stands for "Technical and Vocational Institution", which offers vocational training to students not able to attend SHS. Columns (3) to (5) show the most recent collected information. The estimated treatment effects are in each panel's first row; standard errors are in each panel's second row in parentheses; p-values from the test that a respective treatment effect is non-zero are reported in the third row; multiple hypothesis testing p-values are in the fourth row; control group means are in each panel's fifth row; sample size for the estimation is in each panel's sixth row. Controls include baseline score on Ghana's exam for admission to secondary and vocational schools and region dummies.

Table 3: Tertiary aspirations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Plans to apply			Ever applied		
	2013	2017	2019	2022	2017	2019	2022
Panel A: All							
Treatment	0.240	0.150	0.149	0.093	0.123	0.130	0.159
	(0.023)	(0.023)	(0.024)	(0.021)	(0.022)	(0.023)	(0.024)
P-value	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
Comparison mean	0.431	0.489	0.366	0.173	0.247	0.280	0.305
N	1979	1970	1952	1756	1970	1952	1756
Panel B: Female							
Treatment	0.266	0.150	0.179	0.133	0.149	0.160	0.202
	(0.032)	(0.033)	(0.033)	(0.029)	(0.031)	(0.031)	(0.033)
P-value	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
Comparison mean	0.364	0.427	0.286	0.139	0.211	0.233	0.245
N	1001	997	986	883	997	986	883
Panel C: Male							
Treatment	0.211	0.144	0.114	0.051	0.097	0.098	0.115
	(0.032)	(0.032)	(0.034)	(0.031)	(0.032)	(0.033)	(0.035)
P-value	0.000	0.000	0.001	0.094	0.002	0.003	0.001
Step-down p-val	0.010	0.010	0.010	0.079	0.010	0.010	0.010
Comparison mean	0.500	0.555	0.450	0.208	0.286	0.329	0.366
N	978	973	966	873	973	966	873
P-val male=fem	0.253	0.879	0.169	0.073	0.240	0.163	0.083

Notes: Year of survey in parentheses. Panel A shows results for the full sample, Panel B for females, Panel C for males. The last row shows the p-values for tests that the effects are identical between males and females. "TVI" stands for "Technical and Vocational Institution", which offers vocational training to students not able to attend SHS. The estimated treatment effects are in each panel's first row; standard errors are in each panel's second row in parentheses; p-values from the test that a respective treatment effect is non-zero are reported in the third row; multiple hypothesis testing p-values are in the fourth row; control group means are in each panel's fifth row; sample size for the estimation is in each panel's sixth row. Controls include baseline score on Ghana's exam for admission to secondary and vocational schools and region dummies.

Table 4: Realized Tertiary Education

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ever Admitted		Ever enrolled				Completed	
	2019	2022	2015	2019	2022	2023	2019	2023
Panel A: All								
Treatment	0.060	0.103	0.027	0.041	0.073	0.077	0.035	0.066
	(0.020)	(0.022)	(0.012)	(0.018)	(0.020)	(0.021)	(0.015)	(0.019)
P-value	0.003	0.000	0.023	0.023	0.000	0.000	0.019	0.001
Step-down p-val	0.020	0.010	0.069	0.069	0.010	0.010	0.069	0.010
Comparison mean	0.201	0.207	0.052	0.150	0.169	0.175	0.087	0.135
N	1952	1761	2010	1951	1753	1662	1952	1662
Panel B: Female								
Treatment	0.095	0.159	0.042	0.074	0.125	0.138	0.040	0.108
	(0.028)	(0.030)	(0.017)	(0.025)	(0.028)	(0.030)	(0.020)	(0.028)
P-value	0.001	0.000	0.013	0.003	0.000	0.000	0.048	0.000
Step-down p-val	0.010	0.010	0.089	0.030	0.010	0.010	0.228	0.010
Comparison mean	0.164	0.158	0.042	0.120	0.136	0.143	0.078	0.118
N	986	886	1014	986	884	836	986	836
Panel C: Male								
Treatment	0.024	0.047	0.013	0.007	0.018	0.015	0.030	0.025
	(0.029)	(0.032)	(0.017)	(0.026)	(0.029)	(0.030)	(0.022)	(0.027)
P-value	0.416	0.142	0.447	0.789	0.538	0.600	0.162	0.356
Step-down p-val	0.842	0.564	0.871	0.871	0.871	0.871	0.574	0.782
Comparison mean	0.240	0.257	0.062	0.180	0.202	0.208	0.096	0.153
N	966	875	996	965	869	826	966	826
P-val male=fem	0.074	0.013	0.218	0.070	0.013	0.005	0.734	0.036

Notes: Year of survey in parentheses. Panel A shows results for the full sample, Panel B for females, Panel C for males. The last row shows the p-values for tests that the effects are identical between males and females. "TVI" stands for "Technical and Vocational Institution", which offers vocational training to students not able to attend SHS. The estimated treatment effects are in each panel's first row; standard errors are in each panel's second row in parentheses; p-values from the test that a respective treatment effect is non-zero are reported in the third row; multiple hypothesis testing p-values are in the fourth row; control group means are in each panel's fifth row; sample size for the estimation is in each panel's sixth row. Controls include baseline score on Ghana's exam for admission to secondary and vocational schools and region dummies.

Table 5: Labor Market Outcomes

	(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: All								
Treatment	0.011	0.040	0.039	0.019	0.039	-0.029	-0.080	401.742
	(0.021)	(0.022)	(0.015)	(0.013)	(0.016)	(0.020)	(0.025)	(204.391)
P-value	0.589	0.061	0.008	0.157	0.015	0.153	0.001	0.050
Step-down p-val	0.574	0.218	0.059	0.356	0.059	0.356	0.030	0.218
Comparison mean	0.730	0.754	0.084	0.077	0.087	0.245	0.393	3162.669
N	1952	1657	1951	1952	1655	1952	1657	1641
Panel B: 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	0.911	0.950	0.248	0.248	0.020	0.990	0.139	0.149
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 C: 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	0.941	0.535	0.604	0.990	0.980	0.604	0.594	0.990
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

Notes: See Table 2 notes. Total earnings in last 6 months winsorized at the 99% percentile. Labor market outcomes for 2020 shown in Table A7.

Table 6: Job search

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	If employed: job satisf. (2019)	If employed: Confident can get better job 1-5 (5=very confident) (2019)	Actively searching for job (2019)	If has earnings: actively searching for a job (2019)	Ever migrated to big city to look for a job (2023)	Lives in a big city (2023)	If SHS: receives help from network to find job (2023)
Panel A: All							
Treatment	-0.195	0.029	0.075	0.092	0.055	-0.016	-0.029
	(0.077)	(0.040)	(0.022)	(0.027)	(0.025)	(0.017)	(0.030)
P-value	0.011	0.470	0.001	0.001	0.027	0.348	0.323
Step-down p-val	0.050	0.752	0.010	0.010	0.129	0.752	0.752
Comparison mean	3.750	4.721	0.242	0.197	0.344	0.132	0.286
N	1286	1287	1952	1172	1657	1632	890
Panel B: Female							
Treatment	-0.143	0.066	0.085	0.144	-0.009	-0.024	-0.059
	(0.120)	(0.065)	(0.030)	(0.039)	(0.033)	(0.023)	(0.042)
P-value	0.234	0.311	0.004	0.000	0.778	0.309	0.164
Step-down p-val	0.861	0.901	0.030	0.010	1.000	0.901	0.802
Comparison mean	3.761	4.688	0.198	0.115	0.286	0.126	0.253
N	541	542	986	482	833	821	402
Panel C: Male							
Treatment	-0.240	0.002	0.062	0.054	0.110	-0.009	-0.010
	(0.100)	(0.049)	(0.032)	(0.037)	(0.036)	(0.025)	(0.042)
P-value	0.016	0.962	0.051	0.140	0.002	0.717	0.814
Step-down p-val	0.109	1.000	0.366	0.752	0.030	1.000	1.000
Comparison mean	3.742	4.744	0.288	0.254	0.405	0.137	0.314
N	745	745	966	690	824	811	488
P-val male=fem	0.531	0.438	0.619	0.083	0.015	0.681	0.457

Notes: See Table 2 notes. Column 1: "Job satisfaction" on a scale from 1 to 5 with 1 being "very unsatisfied" and 5 being "very satisfied".

Table 7: Mental Health and Satisfaction

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Mental health index 1-5 (normalized) (2013)	Satisf. index (2013)	Global satisf. with life (2022)	Global satisf. with life (2023)	Life as good as others (2023)	Feasibility of changing your life (2023)	Satisf. index (2023)
Panel A: All							
Treatment	-0.002	-0.001	-0.008	-0.047	0.040	0.013	-0.007
	(0.048)	(0.038)	(0.054)	(0.069)	(0.066)	(0.042)	(0.033)
P-value	0.968	0.972	0.877	0.492	0.542	0.763	0.828
Step-down p-val	1.000	1.000	1.000	0.980	0.980	1.000	1.000
Comparison mean	0.000	3.318	2.604	3.377	3.579	3.419	3.466
N	1981	1981	1748	1656	1657	1652	1657
Panel B: Female							
Treatment	-0.019	0.097	-0.024	0.136	0.054	0.040	0.015
	(0.065)	(0.052)	(0.075)	(0.098)	(0.092)	(0.061)	(0.047)
P-value	0.775	0.062	0.750	0.167	0.559	0.514	0.748
Step-down p-val	1.000	0.564	1.000	0.911	1.000	1.000	1.000
Comparison mean	-0.037	3.310	2.661	3.313	3.583	3.383	3.466
N	1001	1001	881	833	833	830	833
Panel C: Male							
Treatment	0.013	-0.095	0.006	-0.223	0.028	-0.015	-0.026
	(0.069)	(0.054)	(0.077)	(0.096)	(0.094)	(0.059)	(0.046)
P-value	0.849	0.082	0.935	0.020	0.768	0.799	0.564
Step-down p-val	1.000	0.604	1.000	0.158	1.000	1.000	1.000
Comparison mean	0.038	3.327	2.546	3.444	3.576	3.456	3.465
N	980	980	867	823	824	822	824
P-val male=fem	0.828	0.012	0.694	0.010	0.904	0.460	0.573

Notes: See Table 2 Notes. The mental health index consists of asking whether the respondent was each of the following in the past few days: bothered by usually unbothersome things, having trouble focusing, depressed, feeling that everything they did was an effort, hopeful about the future, fearful, and sleeping restlessly. The 2013 satisfaction index consists of the following: life satisfaction, financial satisfaction, and satisfaction of life compared to that of others. All the outcomes regarding satisfaction are scales from 1 to 5 with 1 being "very unsatisfied" and 5 being "very satisfied".

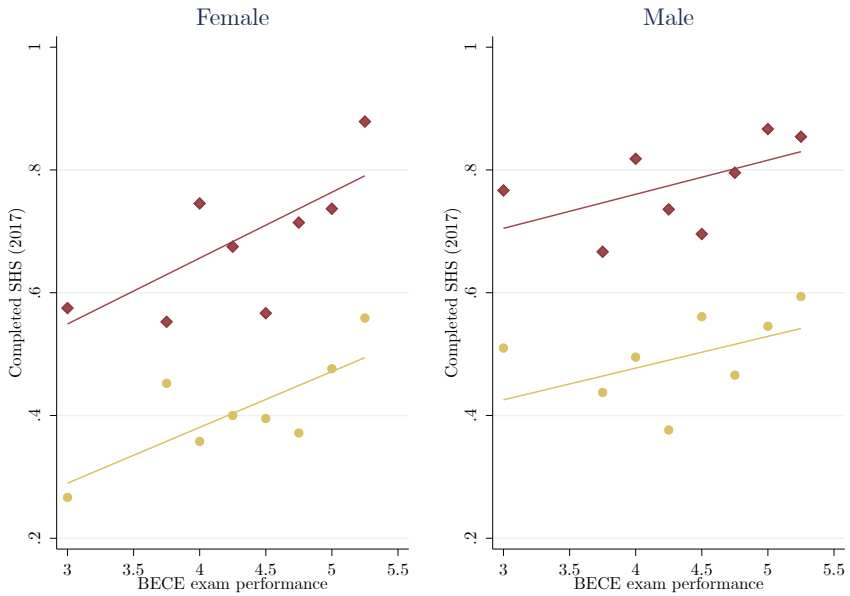
Online Appendix

List of Appendix Figures

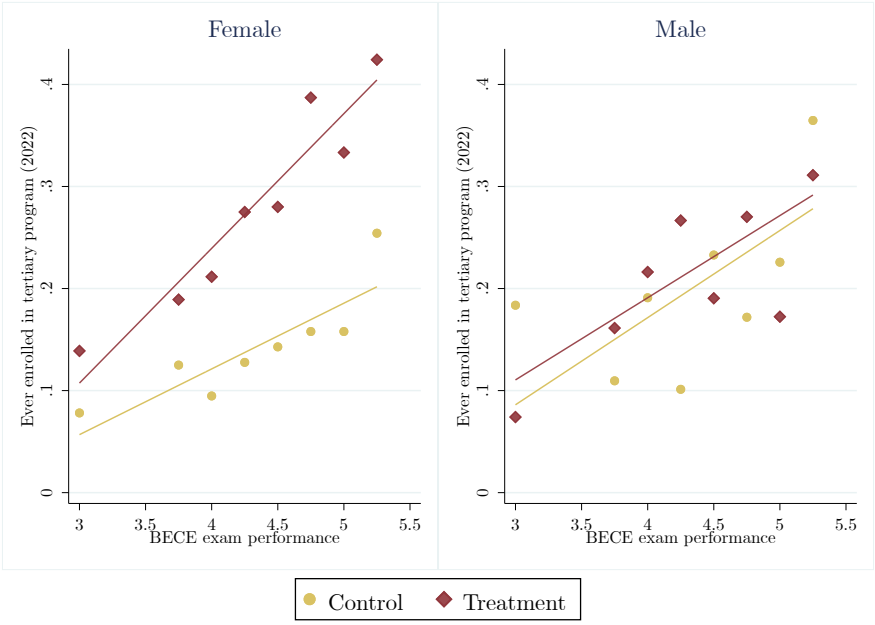
List of Appendix Tables

Figure A1: Impact of scholarship on educational attainment, by baseline score

(a) SHS completion



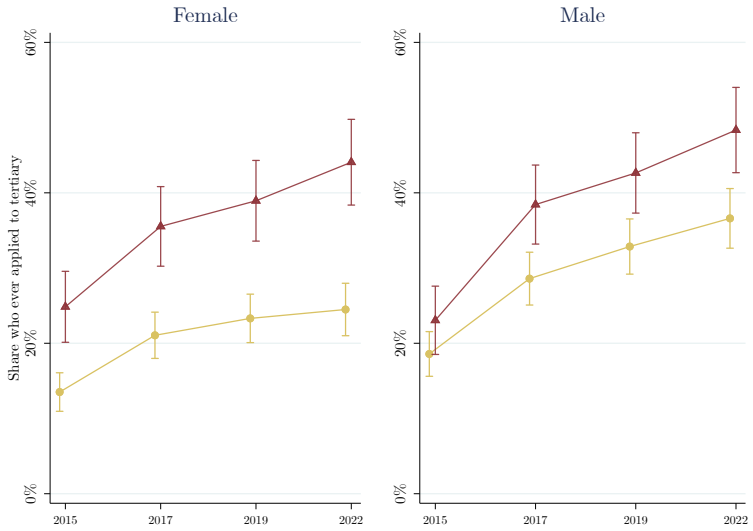
(b) Tertiary Enrollment



Notes: The BECE exam is the Junior High School exit exam. Markers represent the proportions grouped by the BECE exam score attained on the x-axis.

Figure A2: Tertiary education: attempts and enrollment over time

(a) Ever applied to tertiary education



(b) Ever enrolled in tertiary education

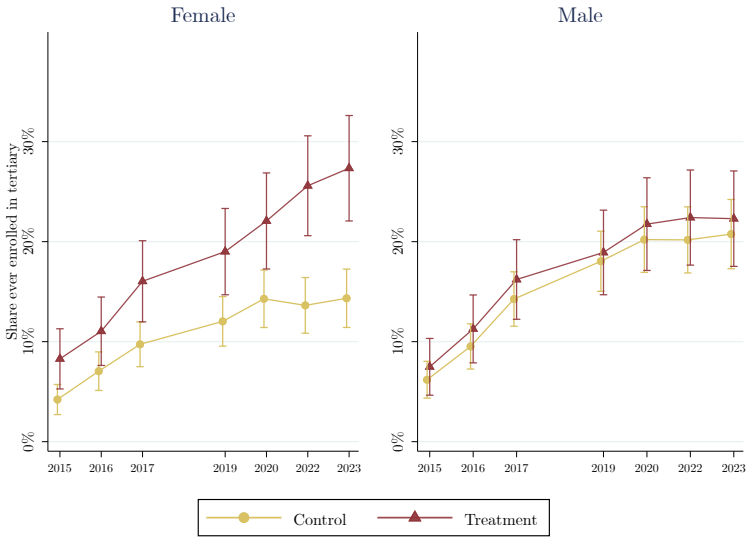
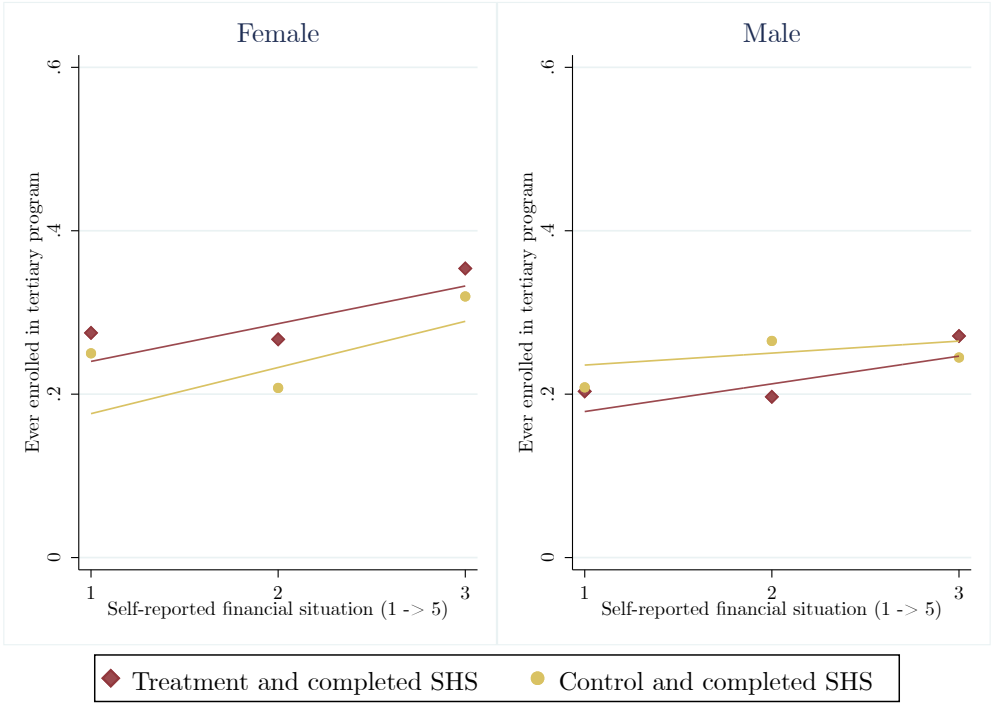
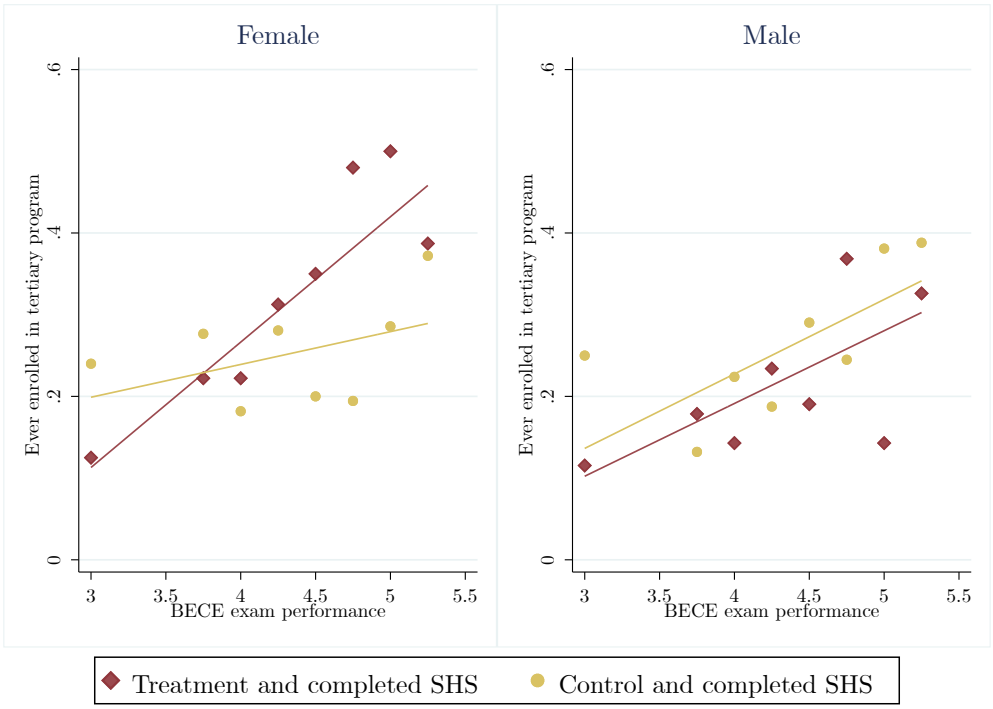


Figure A3: Ever enrolled in tertiary program if completed SHS

(a) By baseline financial situation



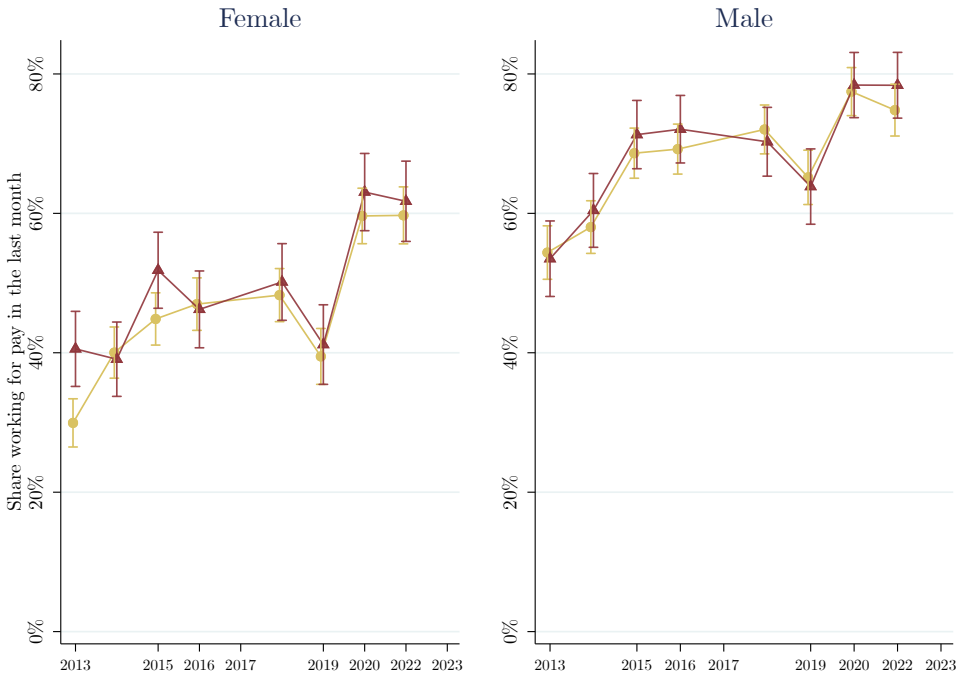
(b) By baseline ability



Notes: Information on tertiary enrollment as of the 2022 survey round. Sample limited to those who completed Senior High School (SHS). Markers represent the proportion ever enrolled in tertiary education grouped by the value on the x-axis.

Figure A4: Labor market outcomes over time

(a) Probability of having worked for pay in the last month



(b) Probability of being a public sector wageworker

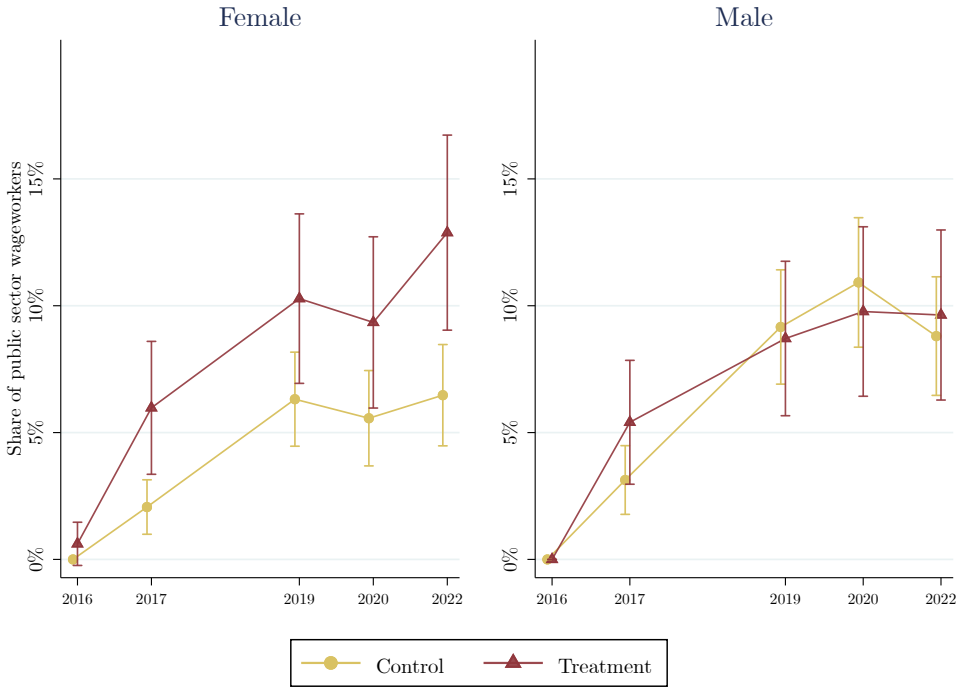
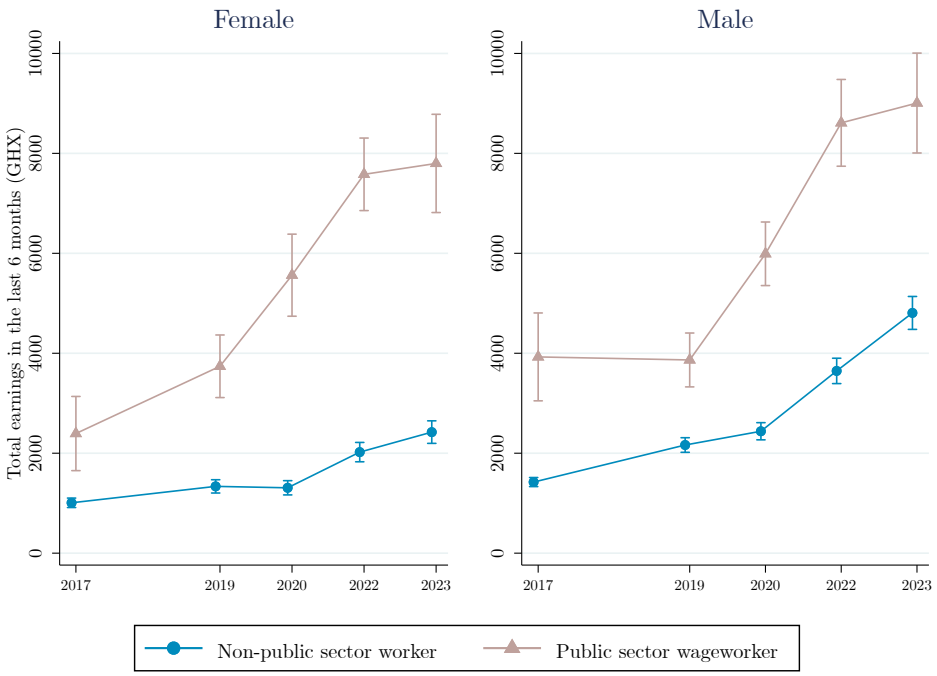


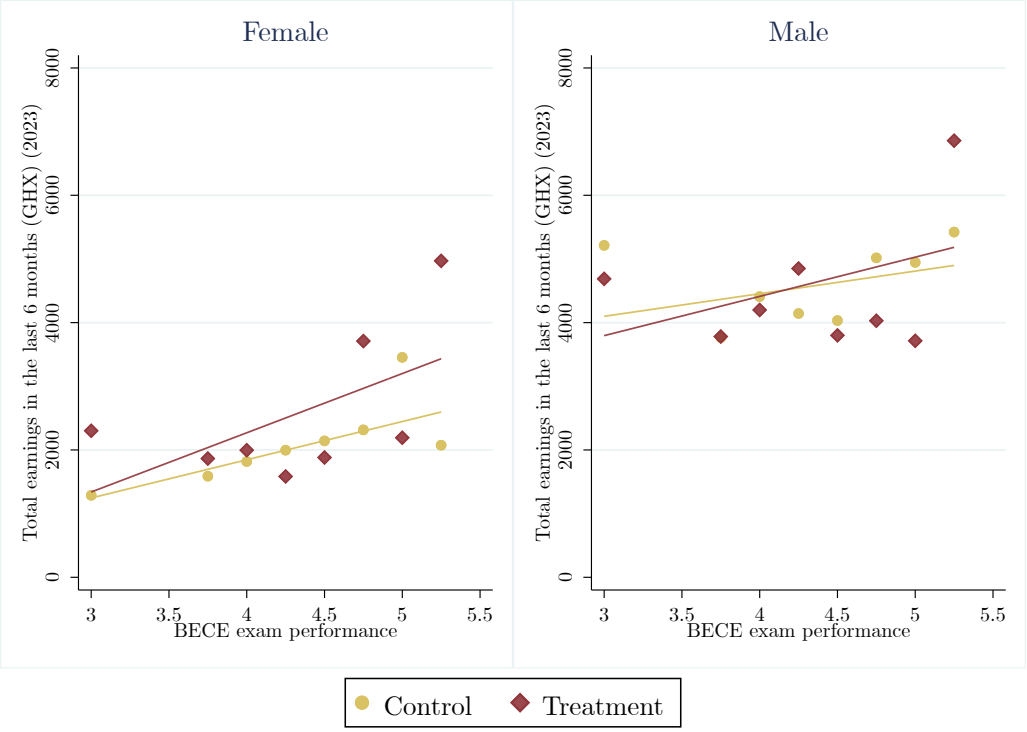
Figure A5: Earnings in the last 6 months, by sector



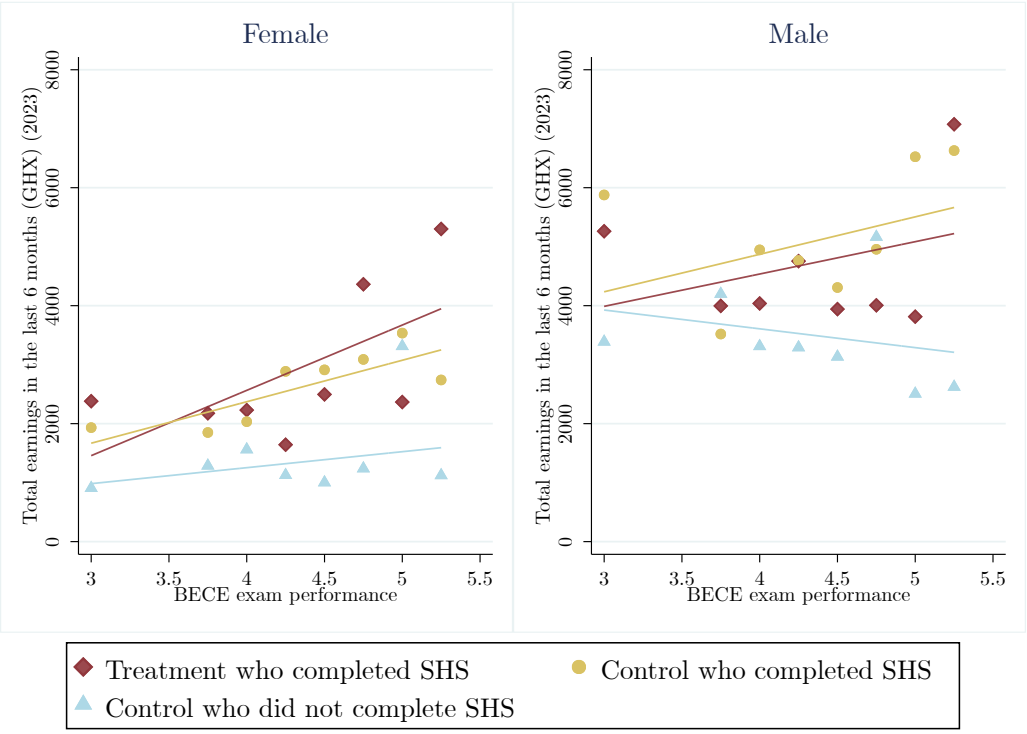
Note: Sample limited to employees. Whiskers correspond to 95% confidence intervals. Earnings winsorized at the 99th percentile.

Figure A6: Earnings in the last 6 months (2023)

(a) By baseline ability

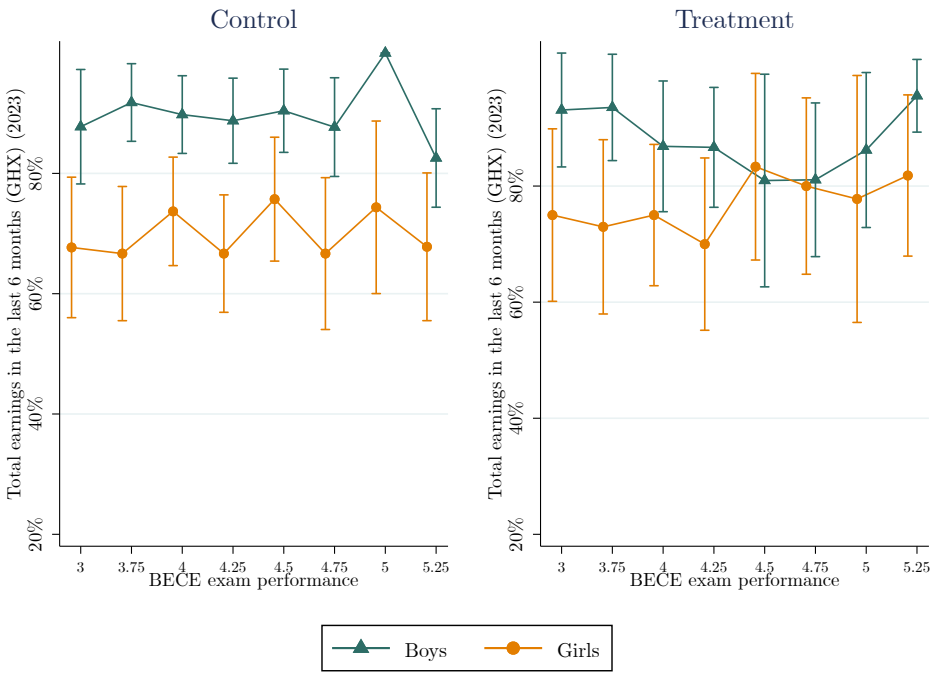


(b) By baseline ability and SHS completion status



Notes: Panel B excludes individuals in the Treatment group who did not complete SHS. Earnings winsorized at the 99th percentile. Markers represent mean earnings in the last 6 month grouped by the BECE exam score attained on the x-axis.

Figure A7: Probability of working for pay, by baseline (2022) ability



Note: Whiskers correspond to 95% confidence intervals. Markers slighltly jittered for legibility.

Table A1: Attrition from surveys over time

	(1) Surveyed (2013)	(2) Surveyed (2016)	(3) Surveyed (2017)	(4) Surveyed (2019)	(5) Surveyed (2020)	(6) Surveyed (2022)	(7) Surveyed (2023)	(8) Refused (2019)	(9) Deceased (2023)
Panel A: All									
Treatment	-0.005	0.009	0.001	0.020	0.041	0.037	0.056	-0.017	0.004
	(0.009)	(0.008)	(0.010)	(0.010)	(0.016)	(0.016)	(0.018)	(0.005)	(0.006)
P-value	0.608	0.263	0.882	0.045	0.010	0.022	0.002	0.001	0.550
Comparison mean	0.963	0.964	0.954	0.939	0.835	0.839	0.784	0.025	0.017
N	2064	2064	2064	2064	2064	2064	2064	2064	2064
Panel B: Female									
Treatment	0.001	0.007	-0.013	0.014	0.046	0.045	0.039	-0.017	0.007
	(0.012)	(0.011)	(0.013)	(0.013)	(0.024)	(0.022)	(0.026)	(0.008)	(0.007)
P-value	0.926	0.487	0.325	0.301	0.051	0.044	0.131	0.032	0.375
Comparison mean	0.967	0.970	0.967	0.947	0.822	0.838	0.792	0.027	0.009
N	1036	1036	1036	1036	1036	1036	1036	1036	1036
Panel C: Male									
Treatment	-0.011	0.011	0.016	0.025	0.034	0.028	0.072	-0.016	0.001
	(0.014)	(0.012)	(0.014)	(0.015)	(0.022)	(0.023)	(0.025)	(0.007)	(0.011)
P-value	0.440	0.379	0.275	0.087	0.124	0.233	0.004	0.020	0.918
Comparison mean	0.959	0.957	0.941	0.931	0.849	0.840	0.776	0.022	0.025
N	1028	1028	1028	1028	1028	1028	1028	1028	1028
P-val male=fem	0.558	0.773	0.127	0.557	0.807	0.589	0.292	0.887	0.679

Notes: See Table 2 notes.

Table A2: Correlates of Attrition in 2022 and 2023

	Coefficient on 2022 attrition		Coefficient on 2023 attrition	
	(1)	(2)	(3)	(4)
	Female	Male	Female	Male
Age in 2008	-0.017*	0.006	-0.018*	0.003
	(0.008)	(0.007)	(0.009)	(0.008)
BECE exam performance	0.052	-0.041	0.323	0.153
	(0.146)	(0.142)	(0.182)	(0.191)
Perceived returns to SHS (%)	-0.045	0.003	-0.066*	-0.011
	(0.027)	(0.021)	(0.027)	(0.025)
Per capita household yearly expenditures	-0.028	-0.031	-0.009	0.022
	(0.031)	(0.023)	(0.034)	(0.037)
Completed SHS (2019)	0.046	-0.022	-0.036	0.048
	(0.033)	(0.030)	(0.036)	(0.034)
Ever enrolled in tertiary program (2019)	-0.060	-0.030	0.057	-0.058
	(0.045)	(0.033)	(0.057)	(0.042)
Total earnings last 6 months (GHX) (2019)	0.004	0.013	0.003	0.006
	(0.009)	(0.008)	(0.010)	(0.007)
Number of children ever had (2019)	0.027*	0.009	-0.020	0.007
	(0.013)	(0.018)	(0.014)	(0.019)
Interaction coefficients:				
Age in 2008 x Treat	0.013	0.000	0.006	0.002
	(0.007)	(0.007)	(0.009)	(0.008)
BECE exam performance x Treat	-0.303	-0.004	-0.080	0.107
	(0.207)	(0.206)	(0.281)	(0.235)
Perceived returns to SHS (%) x Treat	0.017	0.023	0.011	0.020
	(0.032)	(0.042)	(0.033)	(0.041)
Per capita household yearly expenditures x Treat	0.024	0.001	0.018	-0.046
	(0.047)	(0.027)	(0.057)	(0.040)
Completed SHS (2019) x Treat	-0.090	0.008	-0.077	-0.171**
	(0.053)	(0.057)	(0.064)	(0.064)
Ever enrolled in tertiary program (2019) x Treat	-0.027	0.012	-0.169*	-0.005
	(0.054)	(0.050)	(0.072)	(0.059)
Total earnings last 6 months (GHX) (2019) x Treat	0.012	-0.017	0.010	-0.000
	(0.015)	(0.011)	(0.017)	(0.012)
Number of children ever had (2019) x Treat	-0.029	0.020	-0.014	-0.021
	(0.022)	(0.030)	(0.025)	(0.029)
Comparison mean	0.162	0.160	0.208	0.224
N	1035	1028	1035	1028

Notes: Each column shows a separate regression. Dependent variable in columns 1 and 2 is "Attrited from 2022 survey" and in columns 3 and 4 " Attrited from 2023 survey". We include 2019 outcomes as regressors to test whether surveyed respondents in 2022 and 2023 are negatively or positively selected.

Table A3: Returns to Secondary Education: OLS Estimates (Control Group)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total earnings in the last 6 mo.						Log earnings in last 6 mo.		
	2017	2019	2023	2017	2019	2023	2017	2019	2023
Panel A: All									
Years of SHS (2017)	14.16	94.41	356.41				0.05	0.08	0.14
	(19.48)	(29.66)	(67.23)				(0.02)	(0.02)	(0.02)
Completed SHS (2017)				-7.30	339.78	1381.61			
				(72.93)	(111.63)	(248.85)			
P-value	0.467	0.001	0.000	0.920	0.002	0.000	0.030	0.000	0.000
Comparison mean	901.11	1296.45	2543.06	942.70	1297.44	2510.04	6.59	6.99	7.66
Effect size (%)	1.57	7.28	14.02	-0.77	26.19	55.04			
N	1249	1233	1046	1270	1244	1053	861	867	768
Panel B: Female									
Years of SHS (2017)	33.81	140.87	308.34				0.11	0.12	0.17
	(23.51)	(37.96)	(68.84)				(0.03)	(0.03)	(0.03)
Completed SHS (2017)				53.62	493.94	1118.89			
				(89.04)	(140.13)	(252.83)			
P-value	0.151	0.000	0.000	0.547	0.000	0.000	0.001	0.000	0.000
Comparison mean	579.04	737.05	1467.48	632.53	749.98	1466.53	6.23	6.65	7.27
Effect size (%)	5.84	19.11	21.01	8.48	65.86	76.30			
N	646	636	541	658	643	546	381	365	351
Panel C: Male									
Years of SHS (2017)	-37.26	-11.08	293.80				-0.02	0.03	0.09
	(30.26)	(44.60)	(108.92)				(0.03)	(0.03)	(0.02)
Completed SHS (2017)				-168.44	-23.68	1306.90			
				(112.41)	(169.46)	(404.65)			
P-value	0.219	0.804	0.007	0.135	0.889	0.001	0.390	0.232	0.001
Comparison mean	1331.37	2046.10	4011.14	1340.20	2005.28	3855.18	6.96	7.27	8.08
Effect size (%)	-2.80	-0.54	7.32	-12.57	-1.18	33.90			
N	603	597	505	612	601	507	480	502	417

Notes: Sample restricted to control group (scholarship non-winners). Columns 7-9 exclude individuals with zero earnings. Earnings winsorized at the 99th percentile.

Table A4: Comparing Compliers and Always-Takers

	(1) Completed BECE in 2007 (2008)	(2) BECE exam performance (2008)	(3) Number of HH members	(4) Years of education of HH head (2008)	(5) Perceived returns to SHS (%) (2008)	(6) Per capita yearly household expenditure	(7) Self-reported financial situation, 1-5 (5 = very comfortable)
Panel A: All							
Treatment	0.035	-0.003	-0.082	-0.266	24.866	12.833	-0.071
	(0.018)	(0.005)	(0.149)	(0.332)	(39.138)	(29.134)	(0.042)
P-value	0.049	0.609	0.583	0.424	0.525	0.660	0.093
Comparison mean	0.073	0.633	5.704	5.976	292.708	520.680	2.147
N	1060	993	1060	1056	915	1059	1053
Panel B: Female							
Treatment	0.083	-0.008	-0.038	-0.477	37.038	7.657	-0.073
	(0.037)	(0.007)	(0.207)	(0.494)	(56.951)	(36.421)	(0.062)
P-value	0.027	0.293	0.854	0.334	0.516	0.834	0.237
Comparison mean	0.159	0.630	5.652	6.305	301.040	503.221	2.211
N	481	454	481	480	407	481	481
Panel C: Male							
Treatment	0.000	0.001	-0.093	-0.020	20.795	13.826	-0.067
	(.)	(0.007)	(0.212)	(0.450)	(53.852)	(44.679)	(0.058)
P-value	.	0.839	0.662	0.964	0.700	0.757	0.250
Comparison mean	0.000	0.636	5.748	5.698	285.749	535.504	2.092
N	579	539	579	576	508	578	572
P-val male=fem	0.026	0.386	0.880	0.449	0.847	0.938	0.927

Notes: See Table 2 notes. Controls include region dummies. Sample limited to those who had completed SHS as of 2017 (or any year prior). The control group means thus reflects average characteristics of "Always takers" (inframarginal students who would have graduated even without a scholarship), and the treatment coefficients show how different the "compliers" must be(marginal students who could only graduate thanks to a scholarship).

Table A5: Cognitive Skills: Additional Outcomes

	(1) Reading test score (2013)	(2) Math test score (2013)	(3) Memory for digit span (forward) (2013)	(4) Memory for digit span (backward) (2013)	(5) Raven's progressive matrices (2013)
Panel A: All					
Treatment	0.143	0.125	0.009	0.109	-0.001
	(0.044)	(0.046)	(0.120)	(0.086)	(0.119)
P-value	0.001	0.007	0.942	0.207	0.993
Step-down p-val	0.010	0.050	1.000	0.455	1.000
Comparison mean	0.000	0.000	7.544	4.541	6.954
N	1983	1983	1983	1983	1981
Panel B: Female					
Treatment	0.159	0.170	-0.025	0.045	-0.041
	(0.066)	(0.067)	(0.170)	(0.118)	(0.168)
P-value	0.017	0.012	0.882	0.703	0.808
Step-down p-val	0.129	0.099	1.000	1.000	1.000
Comparison mean	-0.096	-0.191	7.381	4.374	6.558
N	1002	1002	1002	1002	1001
Panel C: Male					
Treatment	0.129	0.069	0.037	0.158	0.019
	(0.058)	(0.060)	(0.170)	(0.125)	(0.165)
P-value	0.026	0.254	0.826	0.207	0.907
Step-down p-val	0.188	0.861	1.000	0.752	1.000
Comparison mean	0.100	0.199	7.714	4.714	7.368
N	981	981	981	981	980
P-val male=fem	0.789	0.246	0.801	0.518	0.940

Notes: See Table 2 notes. Reading test score consists of: can read sentence aloud, can read paragraph well (as rated by surveyor), each of: basic, intermediate, and advanced comprehension, and fact identification. Math test score consists of: two basic computations, basic calculator computation, numeracy, two levels of profit calculation questions, identifying mode, calculating sums without help, calculating sums with explanation, calculating percentage, and an exchange rate calculation. Both reading and math test scores are standardized.

Table A6: Education Plans: Additional Outcomes

	(1) Ever sat for WASSCE exam (2017)	(2) Ever sat for WASSCE exam (2019)	(3) Ever applied as Mature Applicant (2022)	(4) Years spent in tertiary education (2019)
Panel A: All				
Treatment	0.271	0.263	0.015	0.088
	(0.022)	(0.022)	(0.012)	(0.051)
P-value	0.000	0.000	0.217	0.087
Step-down p-val	0.010	0.010	0.267	0.178
Comparison mean	0.441	0.464	0.050	0.374
N	1970	1952	1756	1951
Panel B: Female				
Treatment	0.279	0.261	0.014	0.150
	(0.032)	(0.032)	(0.016)	(0.069)
P-value	0.000	0.000	0.362	0.030
Step-down p-val	0.010	0.010	0.733	0.129
Comparison mean	0.383	0.403	0.041	0.308
N	997	986	883	986
Panel C: Male				
Treatment	0.256	0.259	0.015	0.021
	(0.030)	(0.030)	(0.018)	(0.076)
P-value	0.000	0.000	0.414	0.780
Step-down p-val	0.010	0.010	0.733	0.772
Comparison mean	0.503	0.528	0.060	0.444
N	973	966	873	965
P-val male=fem	0.737	0.935	0.907	0.217

Notes: See Table 2 notes.

Table A7: Labor Market Outcomes during COVID Crisis

	(1) Worked for pay in past 6 months (2020)	(2) Self-employed (2020)	(3) Has wage contract with employer (2020)	(4) Total earnings in past 6 months (2020)	(5) Total earnings April (2020)	(6) Coeff. of variation of monthly earnings (if > 0) (GHX) (2020)
Panel A: All						
Treatment	0.045	-0.066	0.047	42.199	32.057	-0.905
	(0.020)	(0.023)	(0.016)	(124.267)	(25.367)	(3.909)
P-value	0.029	0.004	0.003	0.734	0.206	0.817
Step-down p-val	0.129	0.050	0.010	0.950	0.446	0.950
Comparison mean	0.759	0.342	0.081	1813.484	252.273	76.596
N	1751	1745	1742	1684	1727	1258
Panel B: Female						
Treatment	0.056	-0.069	0.067	247.666	65.718	-10.068
	(0.034)	(0.034)	(0.021)	(149.415)	(24.709)	(6.173)
P-value	0.096	0.044	0.001	0.098	0.008	0.103
Step-down p-val	0.455	0.376	0.020	0.455	0.050	0.455
Comparison mean	0.631	0.386	0.049	1021.076	116.919	89.384
N	866	862	862	836	853	518
Panel C: Male						
Treatment	0.027	-0.062	0.027	-197.349	-7.020	5.515
	(0.021)	(0.031)	(0.024)	(187.767)	(42.645)	(5.038)
P-value	0.191	0.046	0.263	0.294	0.869	0.274
Step-down p-val	0.713	0.446	0.713	0.713	0.891	0.713
Comparison mean	0.887	0.298	0.113	2613.083	387.389	67.696
N	885	883	880	848	874	740
P-val male=fem	0.463	0.815	0.221	0.075	0.159	0.047

Notes: See Table 2 notes. 2020 survey was administered over the phone (no in-person tracking) between May 19 and September 25 2020.

Table A8: Aspirations for Own Children's Education

	(1) Aspiration for son's education: University	(2) Aspiration for daughter's education: University	(3) Realistic estimate of son's education: University	(4) Realistic estimate of daughter's education: University	(5) Expects son public sector employee: no SHS	(6) Expects daughter public sector employee: no SHS	(7) Expects son public sector employee: SHS	(8) Expects daughter public sector employee: SHS
Panel A: All								
Treatment	0.023	0.023	-0.020	-0.018	0.001	0.001	0.008	0.016
	(0.018)	(0.020)	(0.025)	(0.025)	(0.007)	(0.007)	(0.017)	(0.019)
P-value	0.198	0.251	0.419	0.457	0.848	0.857	0.624	0.397
Step-down p-val	0.792	0.861	0.960	0.960	1.000	1.000	0.960	0.960
Comparison mean	0.829	0.790	0.444	0.425	0.017	0.021	0.127	0.153
N	1756	1756	1756	1756	1749	1749	1749	1749
Panel B: Female								
Treatment	-0.020	-0.008	-0.062	-0.048	0.007	-0.000	-0.023	-0.012
	(0.027)	(0.029)	(0.035)	(0.035)	(0.009)	(0.010)	(0.023)	(0.025)
P-value	0.453	0.795	0.079	0.165	0.490	0.989	0.312	0.636
Step-down p-val	0.980	0.990	0.594	0.832	0.980	0.990	0.980	0.990
Comparison mean	0.838	0.781	0.463	0.437	0.014	0.020	0.128	0.148
N	883	883	883	883	881	881	881	881
Panel C: Male								
Treatment	0.067	0.052	0.019	0.009	-0.004	0.003	0.040	0.044
	(0.025)	(0.026)	(0.035)	(0.035)	(0.010)	(0.011)	(0.026)	(0.028)
P-value	0.007	0.048	0.584	0.801	0.683	0.768	0.123	0.119
Step-down p-val	0.158	0.505	0.990	0.990	0.990	0.990	0.733	0.733
Comparison mean	0.820	0.800	0.426	0.412	0.021	0.021	0.127	0.157
N	873	873	873	873	868	868	868	868
P-val male=fem	0.017	0.132	0.087	0.196	0.415	0.870	0.072	0.137

Notes: Questions were asked at the 2022 follow-up survey about either existing children or hypothetical children. Panel A shows results for the full sample, Panel B for females, Panel C for males. The last row shows the p-values for tests that the effects are identical between males and females. The estimated treatment effects are in each panel's first row; standard errors are in each panel's second row in parentheses; p-values from the test that a respective treatment effect is non-zero are reported in the third row; multiple hypothesis testing p-values are in the fourth row; control group means are in each panel's fifth row; sample size for the estimation is in each panel's sixth row. Controls include baseline score on Ghana's exam for admission to secondary and vocational schools and region dummies.

Table B1: Impact of Scholarship on Foregone Earnings and Attitudes

	(1) Avg. mo. earnings btw. Jan 2009 and July 2012 (2013)	(2) Trust in general (2013)	(3) Amt. willing to invest in high-payoff but risky business (2013)	(4) Amt. needed in two days to forgo 40 GHS today (2013)	(5) Time consistent (2013)	(6) Present bias (2013)	(7) Extremely impatient in both present and future (2013)	(8) Gap between True and Perceived Rank (2013)
Panel A: All								
Treatment	-7.581	0.083	1.011	-0.993	0.014	0.001	-0.002	-83.869
	(1.162)	(0.035)	(1.365)	(5.917)	(0.024)	(0.021)	(0.013)	(29.721)
P-value	0.000	0.018	0.459	0.867	0.541	0.964	0.857	0.005
Step-down p-val	0.010	0.119	0.921	0.990	0.921	0.990	0.990	0.030
Comparison mean	12.249	0.000	51.077	100.783	0.409	0.258	0.087	804.693
N	1939	1981	1981	1981	1981	1981	1984	1977
Panel B: Female								
Treatment	-5.564	0.150	0.374	-2.128	0.009	0.003	-0.008	-74.725
	(1.214)	(0.048)	(1.970)	(8.110)	(0.033)	(0.030)	(0.018)	(42.189)
P-value	0.000	0.002	0.850	0.793	0.787	0.912	0.646	0.077
Step-down p-val	0.010	0.020	1.000	1.000	1.000	1.000	1.000	0.653
Comparison mean	8.996	-0.044	51.136	99.727	0.400	0.270	0.085	883.759
N	978	1001	1001	1001	1001	1001	1002	998
Panel C: Male								
Treatment	-9.796	0.012	1.838	0.285	0.018	-0.001	0.004	-88.184
	(1.982)	(0.050)	(1.889)	(8.644)	(0.034)	(0.029)	(0.019)	(41.292)
P-value	0.000	0.814	0.331	0.974	0.595	0.982	0.845	0.033
Step-down p-val	0.010	1.000	0.980	1.000	1.000	1.000	1.000	0.386
Comparison mean	15.640	0.047	51.015	101.885	0.418	0.245	0.089	722.464
N	961	980	980	980	980	980	982	979
P-val male=fem	0.062	0.060	0.634	0.859	0.819	0.964	0.670	0.777

Notes: See Table 2 Notes. Column 2 concerns trust. It is a mean aggregate of answers to questions about how much the respondents would trust people from other ethnicities, other religion, the same religion, their neighbors and people from a common tribe. Possible answers go from 1 - never trust to 5 - always trust. The answers have then been standardized and aggregated in a single variable. Column 3 concerns risk preferences. Column 4-7 concern time preferences. Column 8 concern confidence: "True rank" is the rank on the math and reading comprehension test administered during the 2013 follow-up survey. "Perceived rank" is the rank that the respondent reported when asked, immediately after the test: "We are administering this survey to around 2,000 youths your age (1,000 boys and 1,000 girls). All of those we are interviewing completed JHS around the same time as you, in 2007 or 2008. Overall, how do you think your performance on the games will compare to that of the others? Try to guess your rank between 1 and 2,000, with 1 being the person with the highest/top score and 2,000 being the person with the lowest score."