The Impact of Secondary School Subsidies on Skills, Education and Labor Market Outcomes: Experimental Evidence from Ghana*

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Abstract

In 2008, we sampled approximately 2,000 Ghanaian youths who had qualified for secondary school but lacked the means to enroll, and randomly awarded scholarships to a third of them. Drawing on 15 years of follow-up data, we examine effects on education, skills, and labor market outcomes. Winning a scholarship increased the probability of secondary school graduation from 45% to 73%, added 1.3 years of schooling, improved knowledge and skills, and raised the probability of tertiary enrollment from 18% to 25%. Entry into the labor market was slow, as secondary school graduates repeatedly sought admission to tertiary programs. By 2023, labor market participation was high, scholarship recipients were more likely to work for a wage, more likely to hold a public sector job (12.6% vs. 8.7% in the control group), and earned 11% more overall. The implied return to education is similar to the OLS estimate for one extra year of schooling in the control group (10%), though the experimental estimate is noisier. Effects on secondary attainment, skills, and self-employment are similar for men and women, but impacts on tertiary education and public-sector employment are significantly larger for women. Impacts on well-being diverge sharply: relative to the control group, life satisfaction is significantly higher among women who won a scholarship but significantly lower among men. In 2017, Ghana abolished secondary school fees, leading to a large increase in secondary school enrollment, tertiary applications, and admissions. Despite this influx of new graduates, we find no decline in returns to education in the very short run.

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1 Introduction

There is a strong consensus among researchers and policy makers that investment in education is a key factor in growth and development (see, e.g., Woessmann (2016) for a review of the empirical evidence, Gethin (2023) for a recent growth accounting exercise, and the Incheon Declaration (2015)). After tremendous global gains in primary education, secondary education is now seen as the new frontier: the Sustainable Development Goals (SDGs) call for free universal primary *and secondary* education by 2030. Yet, in many Sub-Saharan African countries, secondary education is at best partially subsidized, and often not subsidized at all. The IMF estimates that doubling education expenditures as a share of GDP would be required for the sub-continent to achieve the education SDG. In a context of considerable fiscal pressure in many of these countries, public subsidies for secondary education have become a contentious political issue. Its core question is whether these subsidies pay for themselves, through increased productivity and earnings for the students induced to attend school when it becomes free, or would they mainly be a transfer to current and new students and their parents? Are the returns high enough to justify delaying entry in the labor market by several years—often longer, as secondary school graduates then seek opportunities for further studies? Finally, does secondary education generate other positive externalities that parents and young people fail to internalize when making schooling decisions?

This was exactly the debate in Ghana prior to 2017, when there were substantial annual tuition fees, corresponding to about 20% of GDP per capita. 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. In 2017, those fees were removed. However, the decision was hotly contested by the opposition, which argued that this would lead to a worsening in the quality of education, and a congestion in the number of graduates (Kofinti, 2024).

Despite the large literature on returns to education in labor economics, there is surprisingly little evidence to guide African policymakers. Credible estimates of private and social returns to education tend to focus on middle-income countries (outside of Africa) and on primary education. Gethin (2023) compiles the 16 available IV estimates of returns to education based on schooling expansions; only two are in Africa and only four concern secondary education, all in lower-middle or middle-income countries: Indonesia, Taiwan, China and Mexico. The few existing estimates of the impact of secondary education exploit eligibility thresholds, and find mixed results. In Kenya, Ozier (2018) observes a decrease in low-skill self-employment but does not have data on

earnings; in Cambodia, Filmer and Schady (2014) see no medium-term impacts of scholarships on employment or earnings.[1]

This paper combines a randomized controlled trial (RCT) in Ghana with a 15-year panel dataset to provide the first experimental estimates of the labor market impact of a secondary school scholarship in a low- or middle-income country (LMIC). We then exploit a natural experiment, the free secondary school policy adopted by Ghana in 2017, to estimate the impact of making education free at national scale on educational attainment and labor market outcomes. A companion paper uses the RCT to estimate intergenerational impacts and documents large effects on survival and cognitive development among children of female scholarship recipients (Duflo et al., 2026).

A central feature of the labor market for secondary school graduates in LMICs is the long shadow of the public sector and the scarcity of "good jobs" attractive to secondary school graduates in the private sector. Beyond imparting skills, secondary school serves as a first funnel toward rationed government jobs (e.g., teacher or health worker), which command high wage premia and other perks (Aryeetey and Baah-Boateng, 2015; Barton et al., 2017) but typically require passing a screening exam. This can lead to long periods of queuing, even when the probability of eventual success is low (Mangal, 2024), with three implications. First, estimates of education's impact in other settings or at other schooling levels may not extend to secondary school in LMICs. Second, short-run Mincerian estimates of individual returns will be biased by sorting into queuing and admission by ability (Rankin et al., 2010), since those who enter the labor market early—and for whom returns can be estimated—are a selected subsample; moreover, individual and social returns may not align if secondary education helps some youth join the queue, imposing an externality on others in it. Third, estimates based on students who are marginal for secondary school admission may not be valid for the experiment of making secondary school free, as students who barely qualify for secondary school may not expect to clear the bar for civil service entry.

A related characteristic of labor markets in LMICs is the relatively small number of "good", formal, private sector jobs, leaving many workers self-employed and often under-employed (Brockmeyer et al., 2026). This means secondary school raise access to wage employment, but also that returns to education could be substantially overestimated (in level) if studies focus only on wage earners.

[1]Two studies exploiting regional variation in program intensity find positive labor market impacts for women in Kenya (Brudevold-Newman, 2021) and Uganda (Kazibwe and Li, 2025), but they cannot estimate impacts on men due to data limitations

Our study is well positioned to make progress on these issues in three ways. First, we conduct an RCT: in 2008, randomly selected students who had qualified for secondary school but could not enroll for lack of funds received the offer of a full, four-year scholarship. Second, we use survey data collected over the subsequent 15 years to compare labor market trajectories of scholarship recipients and non-recipients through the first part of their life cycle (up to about age 32). This unusually long horizon matters because students wait a very long time, repeatedly attempting to qualify for tertiary education or for good job opportunities. Third, we collect full income data, including self-employment earnings and farm activity, allowing us to capture the overall income and include low- or zero-earners.

Access to senior high school in Ghana has historically been limited: a gateway exam administered at the end of grade 8 was passed by only about 40% of junior high school entrants at the onset of this study. We generated experimental variation in the cost of secondary school by offering scholarships to randomly selected youth while holding educational requirements fixed. Full scholarships were awarded to 682 of 2,064 rural youth who had gained admission to a public high school but had not enrolled within the first term. We collected follow-up data regularly through 2023, when respondents were on average 32 years old, with a minimal 6% attrition rate by 2019, rising to about 20% by 2023 as COVID-19 disrupted data collection—attrition that compares favorably to other long-run studies, even those that focus on intensive follow-up of a small subsample.[2] Despite its modest sample size, this study is thus unique in following over an experimental sample with access to free secondary education over such a long horizon. We are aware of no comparable dataset.

Scholarships increased educational attainment: while 45% of non-winners graduated from senior high school, scholarship winners were 28 percentage points (63%) more likely to do so, and received 1.26 more years of secondary education on average. Some academics have expressed concern that secondary schools in lower-income countries are not good enough to meaningfully build human capital (Pritchett, 2013). Yet, despite our scholarship recipients attending local (rural) schools, rather than the best available boarding schools, this additional schooling translated into higher cognitive skills: five years into the study, recipients scored 0.16 standard deviations higher on practical math and reading comprehension questions modeled on the Programme for International Student Assessment (PISA).

[2]See Gertler et al. (2014); Blattman et al. (2020); Evans and Ngatia (2020); Banerjee et al. (2020); Hicks et al. (2020).

At baseline, students saw a secondary school degree mainly as the gateway to a government job: respondents often expected to become a teacher or a nurse, and anticipated very large financial returns (276% higher earnings). Consistent with this, when surveyed in 2013, 95% of graduates in both the control and treatment groups planned to apply to a tertiary program (a necessary step toward a government job). Access to tertiary programs is extremely rationed, however, so few students enroll each year. Remarkably, they continue trying for a very long time. By 2023 (ten years after graduation), 22% of control group graduates had enrolled at some point, and a further 17% had not *but were still planning* to.

Winning a scholarship increases subsequent tertiary application rates substantially for both men and women, but affects *realized* tertiary education for women: by 2023, tertiary admission, enrollment and completion rates are double for female winners relative to non-winners (with p-values$<$0.05 in all cases), whereas male scholarship winners are no more likely to gain admission, enroll, or complete a program than non-winners (the male-female difference is significant at the 5% level throughout). Impacts are concentrated among high-ability women (as proxied by the gateway exam score), consistent with many girls not attending school not because of low expected returns but because of credit constraints—and suggesting that credit-constrained parents prioritize boys.

Persistence in seeking a good job finally paid off. By 2023, scholarship winners of both sexes are significantly less likely to be self-employed and more likely to work for a wage (+11 percentage points for women, and +7 percentage points for men).

But one consequence of this protracted path to tertiary education is that, even 10 years after secondary school, a non-trivial share of individuals are still applying for tertiary education or waiting for a formal position rather than gaining experience in the labor market, which has implications for labor market returns. For men, the OLS estimate of the return to one year of education in the control group becomes significantly positive only in 2020, when the average student is 29 years old, at which point the Mincerian return is 6% per year of education. It peaks at 8% in 2023. For women, the OLS estimated return is 20% in 2019 and reaches 26% per year in 2022 and 22% in 2023.

Experimental estimates tell a similar story: for men, we find no significant earnings difference between scholarship recipients and non-recipients even after 15 years (2023, the end of our study period), though confidence intervals are wide. For women, a significant earnings impact emerges in 2020 (+24%, p-value$<$0.1), and persists through 2023 (+30%, p-value$<$0.05); the earnings data

are noisy, however, and we cannot reject equality of the male and female estimates.

What is clear is that winning a scholarship affects mens' and women's reported life satisfaction very differently. In 2013, when they leave school, women who receive a scholarship score 0.12 standard deviation higher than non-recipients on a life satisfaction index, while men recipients score 0.125 standard deviation *lower*. A decade later, in 2023, women recipients are 6 percentage points less likely to report dissatisfaction with life, while men recipients are 6.6 percentage points more likely to do so.

The earnings gains for women are too large to be accounted for by cognitive gains alone, and instead largely reflect greater access to government jobs: in 2023, female recipients were twice as likely as non-recipients to hold a public-sector job (p-value < 0.05). 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. So roughly two-thirds of the gains accrue to women who got jobs as public employees (mostly as teachers or health workers).

Although our study setting presents many advantages (in particular, the randomization and long follow-up), it also has some limitations. In particular, offering scholarships to a relatively small number of students cannot capture what would happen if secondary education became free for everyone who qualifies, since there may be equilibrium effects going in various directions. The first-order effect might be the pecuniary externality, with even greater scarcity of tertiary spots and government jobs. Due to its timing, our experiment probably captures returns in a congested market, because a reform in the duration of secondary school that took place at the same time had the consequence that our sample graduated as part of a double cohort, so they faced steep competition for those spots—all the more so that the government faced a difficult budget situation at the time. There was no expansion in the number of seats in university at the time, and even a freeze in government jobs other than in education and health. However, counteracting this congestion effect, firms may, over time, respond to a larger population of graduates by offering a greater number of skilled positions, and governments may expand tertiary education programs.

One way to address this is to combine experimental estimates with a model, as Fujimoto et al. (2023) do for Ghana, calibrating a general equilibrium macro model of free secondary education using some of our estimates as key parameters. Their conclusion is pessimistic: the returns we find are low enough that free secondary education would reduce GDP, through loss of earnings during school years and negative selection of those for whom the price of schooling matters to

enrollment. Notably, they estimate that 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. As such, their model predicts that the number of secondary schooling graduates would increase by only about 8 percentage points under free schooling (from 34 percent of the population to 42 percent, +24%), and these extra graduates would be negatively selected. Our results, however, suggest something different, at least for women.

In this paper, we approach this question by complementing our experimental results with analyses of how the 2017 free education reform in Ghana impacted the supply and demand for secondary school graduates. Ghana made senior secondary school free starting in the Fall 2017, following an electoral campaign where it was a central issue, and a promise of the winning party. We find that the removal of fees led to an increase of 50% in secondary school attainment, similar to our experimental estimate.

Because the reform took effect only in 2017, and young people take a long time to enter the labor market, it remains early to assess labor market impacts with the data currently available (the latest nationally representative labor market data are from 2024). Another serious shortcoming of available representative datasets is that they include earnings information only for those formally employed, a minority in the Ghanaian context. We thus focus on tertiary education, employment status and sector of employment, rather than earnings. Early evidence suggests that the influx of graduates did not lead to congestion, neither in tertiary education nor in the labor market. The government increased the number of university slots, so the free-secondary school cohort enrolls in university at the same rate as earliery cohorts; and, as in our experiment, the tertiary enrollment rate of female graduates catches up with and overtakes that of male graduates.

Despite the influx of new graduates, the rest of the labor market does not appear to change drastically: the share of youth not in employment or training does not rise, and private sector employment remains extremely low (11% for SHS graduates, and 1% for non graduates) without falling for graduates, so the gap between graduates and non-graduates remains constant. This is true among both the older cohorts (not directly affected by the reform) and the younger cohorts (where we could expect negative selection). Self-employment rates among graduates remain low.

Overall, this paper finds that free secondary education in Ghana leads to greater access to education, and significant gains in cognitive skills, for both women and men. However, they are

then confronted with a labor market that seems to offer them relatively few opportunities. Young people take a very long time to find employment, and positive returns to education emerge only at around age 27 for women and 30 for men. The public sector, which employs approximately 12% of women and men with secondary education by 2023, plays an outsized role in shaping education and job search strategies, with many students postponing entry into the labor market to apply to higher education in the hope of qualifying for these jobs. It seems to have remained the case after the national policy that removed secondary school fees, with the government expanding public university slots, and the private sector still playing a small role in the employment of new graduates. Nevertheless, by age 30 or so, both men and women with a secondary degree earn more than those without.

Besides contributing to the literature on the returns to education, 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 (Groh et al., 2015; Bandiera et al., 2025; Abebe et al., 2025). Our results echo Alfonsi et al. (2022) and Bandiera et al. (2025), who document how distorted beliefs among job seekers in Uganda contribute to prolonging youth unemployment.

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, tertiary education in Section 5 and labor market outcomes and overall satisfaction in Section 6. Section 7 uses secondary, nationally representative data to estimate the short run impacts of Ghana's 2017 Free SHS policy.

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 Certificate 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.[3] As of 2010, girls were 6 percentage points (20%) less likely to ever reach senior high school than boys. A few of those who do not enroll in senior high school enroll in Technical and Vocational Institutes (TVIs).[4]

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 be eligible for 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.[5] 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

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

[4]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).

[5]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.

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.

2.2 The Macroeconomic Context

The effects we measure, be they in our experimental study sample or when studying the national policy, 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, just as the first cohort to complete SHS entirely free graduated. After some rebound in 2021, Ghana fell into an economic crisis in 2022 and growth remained weak in 2023.

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 except in the health and education departments. The net hiring freeze ended in April 2019.

The government also changed their secondary education policy during our experimental 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, who started SHS on a scholarship for academic year 2008-2009, were thus the last cohort 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, making it more difficult to quickly enter tertiary education (as shown by Awadey (2025)), something they could not have anticipated when they made their

decision to enter secondary school.

This context probably exacerbated the difficulties of the graduates in our cohort to get rationed government jobs. As such, while our experiment was small, and thus could not have had general equilibrium effects, our partial equilibrium estimates are probably closer to what a large influx of new SHS graduates would experience.

3 Research Design, Data and Sample Characteristics

3.1 Sampling Frame

The sample was drawn from 54 rural districts from five regions.[6] Across these 54 districts, we sampled among students admitted at 177 publicly funded senior high schools (SHS) accepting only day (i.e., non-boarding) students.[7] 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.

Students needed to satisfy the following criteria to be eligible for the study: (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),[8] (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.[9] 95% cited financial difficulties as the main reason, 2% cited pregnancy and 3% cited a variety of

[6] 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. Greater Accra was excluded given our focus on poorer areas. We sampled districts from the remaining five regions.

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

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

[9] In practice, we identified those students as follows: We went down the list of SHS in the selected districts, and asked them to identify students that had been admitted to the school as per the centralized placement system, but had not started school in the new academic year. We then went to the JHS of those students to ask whether the student had enrolled in another SHS, and if not, we visited the student at home to ask the reason why the student had not enrolled in SHS, without specifying the reason for the survey. We did this process until we had identified around 2,250 students (this was our target sample size given our budget). The overwhelming majority of people we could find at home agreed to answer questions. We do not know how many students in this situation (='eligible') we would have found in total had we done this systematically for all SHSs.

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 in a senior high school for the second term of the 2008-2009 school year. A total of 182 students who had enrolled were dropped from the sample prior to randomization. (The scholarship program was announced to students, headmasters, and surveyors only 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.[10]

3.2 Scholarship Program

The scholarship program was implemented by Innovations for Poverty Action Ghana (IPA), 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 (Parent-Teacher Association) dues, and other levies and supplies, including exam fees. The latter two costs are school-specific. 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 USD480 per student who completed senior high school.

Winners were notified by phone in January 2009 and encouraged to immediately report to their placement SHS. 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

[10]To reach 50% female in the sample, we included girls who had graduated from JHS and gained admission into one of the 177 sampled SHSs in July 2007, but had still not enrolled as of October 2008.

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.

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 for their child in the absence of the scholarship ("always-takers", or "infra-marginals"). Specifically, for those families, 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.[11] 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.[12]

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 forgo labor market earnings while in school and incur extra expenditure on school materials. Based on our estimates of forgone 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 8). Scholarships could also be affecting effort in

[11] All GHX numbers reported in 2017 GHX.

[12] Recent evidence from Tanzania suggests that secondary school costs do matter for households' disposable income: before free secondary education was passed, younger siblings of children barely admitted to secondary school were less likely to enroll in secondary school themselves (Ferreira and Sandholtz, 2024)

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 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 be tracked in person) almost yearly from 2015 to 2023.

3.4.1 Baseline Survey

In November and December of 2008, prior to selecting scholarship winners, a baseline survey was administered to the students 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.

3.4.2 Randomization

The final study sample of 2,064 students 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 and sim cards were distributed at baseline 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 B2 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 B3 shows the correlates of attrition separately for the treatment and the control groups in 2022 and 2023. Attrition is slightly higher for those who ever migrated, not differentially so in the treatment group. We however do see evidence of differential attrition on other covariates—in particular, women in the treatment group who ever enrolled in tertiary are relatively less likely to attrit, and men in the

[13]Regressing the 2017 value for total years of education on refused 2019 survey yields a coefficient of -1.65 (p-value=0.03). For total earnings in the past 6 months the coefficient is -466 GHX (p-value 0.24).

treatment group who ever completed secondary are relatively less likely to attrit. Given this, we (a) systematically report the 2019 results alongside the 2022 and 2023 results, and (b) estimate the treatment effects on all key 2023 outcomes using entropy balancing in Table B4, and find the results are unchanged.

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, and labor market expectations, 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.

3.4.5 Yearly Callback Surveys

Yearly mini-callbacks were conducted between 2008 and 2014 to update respondents contact information and education status. Starting in 2015, the callbacks included a 30-minute survey on major life outcomes, in particular: tertiary education, occupation and earnings (including self-employment earnings, e.g. for small business owners and farmers).[14] A COVID callback was conducted between May and September 2020. The last callback survey was conducted in the Spring of 2023.

3.4.6 Outcomes

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 separately for each panel (full sample, females only, males only).

[14] Appendix B.1 describes how earnings were measured.

3.5 Characteristics of Study Sample

Key summary statistics on the study sample and baseline balance are shown in Table A1. As a test for balance, we show mean differences across groups for a battery of outcomes. Specifically, we run regressions of the form:

$$Y_i = \alpha + \beta T_i + \mathbf{X}_i\boldsymbol{\gamma} + \epsilon_i \tag{1}$$

where Y is the outcome of interest and T is whether or not the student won a scholarship. For each variable of interest, we show $\hat{\beta}$, the difference between the treatment and control group, and its standard error. For all regressions, the controls in $\mathbf{X}_i$ are region fixed effects and junior high school finishing exam (BECE) score. 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.

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).

Students 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 A1, column 7). These high expected average returns are not driven by outliers: 47% thought the returns would be at least 100%. Students saw a secondary school degree as the gateway to a government job (Panel A of Figure A1). Over half thought they could be a government employee or teaching (a profession dominated by government employees) by the age of 25 if they completed senior high school (if we consider all those who mentioned at least one of these options, it is 65% of females and 60% of males).

4 Impacts on Secondary Education and Learning

4.1 Secondary schooling

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.[15] This section presents the effects of the scholarship on educational attainment and skills.

We estimate the impact of the scholarship on educational attainment using regressions similar to equation (1). The results are presented in Table 1.

By 2017, 72.6% of the scholarship winners had completed SHS, compared to 44.6% of the non-winners.[16] 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 2017 survey while in the treatment group, only 0.6% had done so (Table 1, column 4).

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%).[17] The effect of scholarships on SHS completion is large at all levels of the initial test score distribution (Figure B1). 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.

Overall, by 2022, the scholarship had led to 1.26 additional years of SHS education, and 1.33

[15] 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%. A recent paper documents large impacts of the free secondary education policy in Tanzania (Sandholtz, 2024). 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.

[16] 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 A2).

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

higher total years of education on average (Table 1, columns 4 and 6).

Table 1: Secondary Education Outcomes

	(1) Total years of education to date (2013)	(2) Completed SHS (2017)	(3) Total years of SHS (2017)	(4) Completed TVI (2017)	(5) Total years of education to date (2022)
Panel A: All					
Treatment	1.190***	0.279***	1.258***	-0.025***	1.312***
	(0.076)	(0.022)	(0.078)	(0.006)	(0.114)
P-value	0.000	0.000	0.000	0.000	0.000
Step-down p-val	0.001	0.001	0.001	0.001	0.001
Comparison mean	10.787	0.446	1.853	0.031	11.425
N	2064	1970	1944	1970	1704
Panel B: Female					
Treatment	1.198***	0.276***	1.202***	-0.008	1.440***
	(0.112)	(0.032)	(0.118)	(0.009)	(0.166)
P-value	0.000	0.000	0.000	0.339	0.000
Step-down p-val	0.001	0.001	0.001	0.377	0.001
Comparison mean	10.575	0.398	1.651	0.019	11.056
N	1036	997	983	997	860
Panel C: Male					
Treatment	1.183***	0.282***	1.310***	-0.042***	1.178***
	(0.101)	(0.030)	(0.103)	(0.009)	(0.156)
P-value	0.000	0.000	0.000	0.000	0.000
Step-down p-val	0.001	0.001	0.001	0.001	0.001
Comparison mean	11.006	0.497	2.066	0.044	11.806
N	1028	973	961	973	844
P-val male=fem	0.970	0.780	0.396	0.004	0.301

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. Controls include BECE score and region dummies. "TVI" stands for "Technical and Vocational Institution", which offers vocational training to students not able to attend SHS. For each panel, the first row shows the estimated treatment effects; the second row shows the standard error in parentheses; the third and fourth row show the basic p-value and the step-down p-value correcting for multiple hypothesis testing; the fifth row shows the mean of the dependent variable for non-winners. **Total Years of Education (2013)** is calculated as follows: We impute a minimum of 9 years for everyone in the sample, representing the standard durations of primary (6 years) and junior secondary school (3 years); to this base of 9, we add years of senior high school attendance as reported by the respondent: 4 years for those who completed SHS, a prorated amount based on the number of years/months attended for those who dropped out. We add one year for those ever enrolled in vocational training. We calculate **Total Years of Education (2022)** by adding to the base of 9 years the total years spent in senior high school as reported in the 2016 survey, the years spent in vocational training as reported in the 2020 survey, and the years spent in tertiary education as reported in the 2022 survey.

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)? To study this, we compare 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 completed SHS. We find surprisingly few differences between the two groups (Table B5). This suggests that targeting scholarships based on need using a proxy-means test could be difficult, at least in this sample of people who all have to delay enrollment due to lack of funds.

4.2 Skills

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 columns 1-3 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 study participants had time to complete senior high school, but before they had a chance to enroll in tertiary education.

In the full sample, scholarship winners score 0.152 standard deviations higher (we see gains both in math and in reading). This effect is quite large, given that the difference in graduation rates is around 25%. The learning gains for *compliers* are thus likely quite substantial. The point estimates are larger for females (0.195) 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 years 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.

Columns 4-7 of Table 2 show impacts on other skills also measured in 2013. Scholarship winners scored higher on a series of questions related to current political affairs. They were also more likely to report engaging with the media, and more likely to know how to use the internet. These gains

Table 2: Ability and skills

	(1) Total cognitive score (2013)	(2) Reading score (2013)	(3) Math score (2013)	(4) Political knowledge score (2013)	(5) Media engagement (radio, news-paper, TV) (2013)	(6) Knows how to use internet (2013)	(7) Has a bank account (2013)	(8) Used internet in the past month (2019)
Panel A: All								
Treatment	0.152***	0.141***	0.120***	0.091**	0.056**	0.047**	0.056**	0.056**
	(0.045)	(0.044)	(0.045)	(0.045)	(0.025)	(0.021)	(0.023)	(0.023)
P-value	0.001	0.001	0.008	0.041	0.023	0.022	0.014	0.018
Step-down p-val	0.006	0.018	0.052	0.069	0.069	0.069	0.057	0.069
Comparison mean	-0.000	-0.000	-0.000	0.000	-0.020	0.687	0.314	0.493
N	1983	1983	1983	1981	1981	1951	1984	1950
Panel B: Female								
Treatment	0.195***	0.159**	0.170**	0.124**	0.074**	0.049	0.098***	0.077**
	(0.069)	(0.067)	(0.067)	(0.063)	(0.032)	(0.033)	(0.031)	(0.033)
P-value	0.005	0.017	0.012	0.049	0.023	0.135	0.001	0.021
Step-down p-val	0.029	0.078	0.063	0.101	0.078	0.132	0.008	0.078
Comparison mean	-0.175	-0.096	-0.191	-0.239	-0.165	0.588	0.236	0.402
N	1002	1002	1002	1001	1001	986	1002	985
Panel C: Male								
Treatment	0.113*	0.129**	0.069	0.061	0.035	0.047*	0.016	0.033
	(0.059)	(0.058)	(0.060)	(0.064)	(0.037)	(0.026)	(0.033)	(0.033)
P-value	0.054	0.026	0.254	0.342	0.347	0.066	0.630	0.310
Step-down p-val	0.291	0.187	0.777	0.777	0.777	0.345	0.777	0.777
Comparison mean	0.183	0.100	0.199	0.250	0.131	0.791	0.396	0.590
N	981	981	981	980	980	965	982	965
P-val male=fem	0.368	0.785	0.244	0.463	0.395	0.998	0.067	0.416

Notes: See Table 1 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. The political knowledge score is the standardized number of correct answers to seven questions about Ghanaian politics: the names of the president and vice president; the party in power before the 2012 election; the NPP presidential running mate; the presidential term limit; the number of candidates in the 2012 presidential election; and the number of new constituencies created for the 2012 general election. The media engagement index is the mean of standardized measures of the number of days in the past seven days spent listening to the radio, reading a newspaper, watching television, and using the internet, plus indicators for reading news online in the past seven days and having a preferred newspaper. Standardizations use the control-group mean and standard deviation.

persisted: regular internet usage remains higher for the treatment group in 2019, particularly among women (column 8). Turning to other technologies, we find that the scholarship accelerates adoption of bank accounts among women—here again, helping reduce the gender gap. We find no difference in IQ, as measured by Ravens matrices and digit span (which should not depend on education but do depend on concentration and effort) (Table B6).

5 Tertiary Education and Queuing

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 (Figure A3). But not all of them succeeded. Among non-winners, 37% of men had ever applied by 2022, 26% had ever been admitted, and 20% had ever enrolled; just 15% had completed tertiary as of 2023 (Table 3). For women in the comparison group, the figures are 25%, 16%, 14% and 12%, respectively.

Turning to treatment effects, we see important heterogeneity by gender. While both male and female scholarship winners are significantly more likely to apply to tertiary than the control group (Figure A3), treatment effects on tertiary education matriculation and completion 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% (Table 3), while the effects on men are small and insignificant, and we can reject equality between estimates for men and women.[18]

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*).[19]

For inframarginal women, the fraction of SHS graduates who eventually enroll in tertiary is 32% (0.143/0.398). If one were to assume that the treatment effect on tertiary enrollment was due entirely to marginal students, 50% (0.138/0.274) of the young women induced to complete SHS by the scholarship would have gone on to tertiary education, which is larger than the enrollment among infra-marginal women. It is however possible, and likely, that part of the effect is due to women who would have completed SHS even absent the scholarship, but would not have afforded

[18] One notable gender difference concerns the type of tertiary programs students apply to. Women's applications are evenly split between university, nursing college and training college (Table A2). Treatment effects on tertiary applications and, for the most part, admissions, are seen across types of tertiary programs among women, though ultimately the treatment effect on enrollment is only significant for university and nursing college. In contrast, among men in the control group, 61% of those applying to tertiary apply to university or polytechnics, with teaching college a distant second (22%) and nursing college sought out by only 10%; treated men apply to university more but to polytechnics less, resulting in a small net effect. There is a significant treatment effect on men's applications to teaching college, but not to nursing college. Program costs, admission rates conditional on applying, and enrollment rates conditional on admission are not systematically lower for the treatment group, though interpreting these results is difficult since the samples are small (Table A3).

[19] Even assuming that the treatment effect on tertiary enrollment is due entirely to marginal students, which is likely not the case since not having to pay tuition in secondary school could affect outcome for inframarginal 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.

Table 3: 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	0.059***	0.102***	0.027**	0.041**	0.072***	0.076***	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	0.025	0.000	0.000	0.019	0.001
Step-down p-val	0.009	0.001	0.040	0.040	0.004	0.004	0.040	0.004
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	0.096***	0.158***	0.042**	0.074***	0.124***	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	0.046	0.000
Step-down p-val	0.001	0.001	0.016	0.005	0.001	0.001	0.045	0.001
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	0.823	0.463	0.823	0.823	0.823	0.823	0.467	0.799
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	0.070	0.014	0.214	0.067	0.013	0.005	0.722	0.036

Notes: See Table 1 notes.

tertiary—i.e., the scholarship allowed their family to save on SHS fees and invest in tertiary instead. To gauge what share of the treatment effect on tertiary education comes from infra-marginal vs. marginal women, we look at how the treatment effects on secondary vs. tertiary vary across regions with different secondary school effects in Figure A4, and whether they seem to align (in the spirit of a Hausman test). In two regions, the Brong Ahafo and Western regions, the treatment effect (in percentage points) is somewhat *larger* for tertiary enrollment than for secondary completion, which implies that at least some of the tertiary effect in these regions must come from infra-marginal girls.

While we see significant impacts of the secondary school scholarship on tertiary enrollment, they are well below 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 (Figure A3). 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. This suggests that over-optimistic expectations of admission into tertiary may distort investments to acquire labor market experience.

6 Labor Market Impacts

This section discusses labor market impacts up to 15 years after the issuance of the scholarships. 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. Both are significantly more likely in the treatment group because graduation from secondary school is more likely in this group. The likelihood of earning income increases over the study period but relatively slowly, and with a lull between 2016 and 2020 (Figure B2a), consistent with queuing for tertiary admission.

Year 2019 is our last low-attrition year (6%). 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%), though still relatively modest given that these are the 14th and 15th year follow-ups. We thus present our main experimental results for 2019 and 2023. We also present a comparison with OLS estimate in our sample and in a nationally representative sample. Due to the timing of that survey, we present those results for 2022.

6.1 Experimental results: Long-Run Labor Market Outcomes

We start with a high-level summary of the impact of secondary school scholarship on labor market outcomes by 2019 (columns 1-4) and 2023 (columns 5-8) in Table 4. Starting with 2019, there is no significant impact on labor market outcomes on average in the full sample (panel A). There is no statistically significant effect for men on any outcomes (panel C), while for women (panel B)

[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.

there is a sizable increase in the likelihood of having a public sector job (4.2 percentage points from a mean of 6.3%, p-value 0.030).[21] But there is no statistically significant treatment effect on earnings for women overall.

Table 4: Labor Market Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2019				2023			
	Self-empoyed	Wage-employed	Public sector wageworker	Total earnings last 6mo	Self-employed	Wage-employed	Public sector wageworker	Total earnings last 6mo
Panel A: All								
Treatment	-0.027	0.028	0.019	24.468	-0.073***	0.088***	0.039**	339.338*
	(0.020)	(0.022)	(0.014)	(88.925)	(0.024)	(0.025)	(0.016)	(194.893)
P-value	0.166	0.209	0.159	0.783	0.002	0.000	0.017	0.082
Step-down p-val	0.545	0.545	0.545	0.727	0.091	0.091	0.091	0.455
Comparison mean	0.245	0.345	0.077	1438.459	0.393	0.347	0.087	3118.031
N	1952	1952	1952	1915	1657	1657	1655	1637
Panel B: Female								
Treatment	-0.014	0.035	0.042**	36.786	-0.094**	0.108***	0.067***	545.468**
	(0.030)	(0.030)	(0.019)	(108.268)	(0.037)	(0.033)	(0.023)	(232.973)
P-value	0.644	0.232	0.030	0.734	0.010	0.001	0.003	0.019
Step-down p-val	0.909	0.455	0.182	0.909	0.091	0.091	0.091	0.091
Comparison mean	0.287	0.232	0.063	953.976	0.496	0.228	0.067	1961.960
N	986	986	986	973	833	833	833	831
Panel C: Male								
Treatment	-0.042	0.022	-0.003	10.702	-0.055*	0.071*	0.012	137.341
	(0.026)	(0.034)	(0.019)	(142.002)	(0.032)	(0.036)	(0.023)	(312.678)
P-value	0.106	0.512	0.874	0.940	0.085	0.053	0.596	0.661
Step-down p-val	0.727	1.000	1.000	1.000	0.545	0.455	1.000	1.000
Comparison mean	0.201	0.464	0.092	1955.346	0.284	0.472	0.108	4364.069
N	966	966	966	942	824	824	822	806
P-val male=fem	0.560	0.727	0.090	0.930	0.446	0.434	0.072	0.285

Notes: See Table 1 notes. Total earnings in last 6 months trimmed at the 99th percentile. Columns 3 and 7: Public sector employment status based on the survey question asked of those who reported being wage-employed: "Do you work in the public or private sector?".

By 2023, outcomes are markedly different. In the whole sample, self-employment is 7.3 percentage points lower among scholarship winners, while wage-employment is 8.8 percentage points higher. These statistically and economically significant effects are observed among both men and women. Winning a scholarship doubles the likelihood that women have obtained a public sector job (from 6.7% to 13.4%), but consistent with the tertiary education results, it does not do so for men (the p-value of the difference between the impact for men and women is 0.071). Earnings are 30% higher for women who won a scholarship compared to non-winning

[21] The positive treatment effect on public employment for women is concentrated among the top of the initial test score distribution (Figure B1c); it appears in 2017 and grows over time (Figure B2b).

women (p-value 0.019), but the point estimate for men though noisy, is still not significant (Table 4 column 8). It should be noted that, for earnings, we cannot reject equality between men's and women's estimates, however.

Figure 1: Impacts on sector of occupation after 11 and 15 years



Notes: The four panels in each subfigure show control group means in 2019; treatment effects in 2019; control group means in 2023, and treatment effects in 2023. For treatment effects, confidence intervals of 90% indicated by whiskers and 95% indicated by the ends of the line. High-skill services in the private sector include banking, engineering, accounting, journalism, and pharmacy, among other professions. Public service includes nursing, teaching, police and military, and government work.

The gains in earnings among women do not seem to be primarily driven by their increased skills. Using observational estimates of the returns to skills shown in Table A4, only about 15% of the earnings gains can be explained by the gains in cognitive skills documented in subsection 4.2.

What explains the rest?

The impacts on type of work and on earnings seem to be related to sector of occupation. Figure 1 shows the distribution of primary occupation by sector in the control group, and estimated treatment effects, for both 2019 (left panel) and 2023 (right panel). There is a negative, significant effect on being out of the labor force or in the low-skill, private service sector for women. The positive impact on public employment is driven entirely by women becoming teachers (+4pp from a base of 3%) or a health worker (+2pp from a base of 2%). Note that despite the rural sample, participation in agriculture as a primary occupation is very low in our sample, with only 4% of women and 10% of men reporting working in the sector in 2023, and it appears unaffected by the treatment.[22] Finally, there is still a small difference, as of 2023, in educational enrollment between scholarship winners and non-winners among women, though this concerns a very small share of the sample (3% vs. 1%).

6.2 Returns to education for young adults: OLS versus IV estimates

There are very few examples of causal estimate of returns to secondary education using either natural or randomized experiment in the developing world. As this project made clear, part of the reason is that they are difficult to obtain. As the contrast between 2019 and 2023 shows, it takes a long time to see returns materialize, so any RCT requires a long follow-up. Natural experiments are not readily available, and the data is scattered. For this reason, it is useful to see whether the OLS estimate appear to be reasonably informative: we thus perform a "Lalonde"-type exercise to compare our IV estimate of the returns to education to the OLS estimate in our sample and in the country at large.

In Table 5, we present evidence on the long term impact of secondary education, comparing several sources: the experimental variation generated by the scholarship randomization, the natural variation present in our control group, and observational data from the Annual Household Income and Expenditure survey (AHIES), a survey on a nationally representative sample. To this end, we estimate a classic regression of Mincerian returns in year 2022 in our main sample, and in a sample of youth age 27–32 in alternative data set. We pick 2022, because this is when the AHIES was fielded, so the data is more comparable. The only difference from

[22] In 2022, we also measured unpaid contributions to the family farm and other family businesses. We see no differences between treatment and control groups in non-remunerated labor. We report these results in Table B7.

the standard regression equation is that we estimate it in level rather than log, because a significant share of people have zero earnings.

$$y_{it} = \alpha + \beta S_{it} + X_{it}\gamma + \epsilon_{it} \tag{2}$$

To exploit the experimental variation, we estimate equation (2) using instrumental variables, with the assignment to the lottery as an instrument. For the reasons discussed in subsection 3.3, the lottery is not a perfect instrument: there could be direct effects of winning a lottery on always-takers (those who would have gone to school even without the scholarship), through income effects for the family (since they don't need to pay tuition), or through the direct psychological impact of winning a scholarship. So we consider these estimates to be suggestive rather than definite. That said, they are useful to put the estimate on the same scale as the OLS estimate.

In our control group, we estimate equation (2) using simple OLS and OLS with control selected using doubly-robust machine learning to control for all the variables we observe in our data set (Chernozhukov et al. (2018)). We also compute nationally representative but non-experimental estimates using the AHIES. We focus on respondents aged 27–32 years who have completed at least Junior High School (JHS) (since all respondents in the RCT study sample have completed JHS by design, and are on average 31 years old in 2022).

One limitation of the AHIES survey is that earnings are collected only for wage earners and casual workers, not for those who are self employed, and only for those who are currently employed. This is a strong limitation considering that the majority of young adults in our sample (and nationally) are not earning anything or are self employed, i.e., not working for a wage. Missing the extensive margin could lead to overestimating the returns to education, if the earnings in the sample not working for a wage are lower on average. Therefore, for comparison, we also include the OLS estimate among wage earners with positive earnings in our control group. In addition, columns (6) to (10) reproduce the exercise but use the probability to be working for a wage. We can do this not only in our own control group data and in the AHIES sample, but also in the 2021 10% sample census, a much larger data set, but which does not include earnings.

The results are shown in Table 5. The IV estimates are similar to the experimental estimate of the effect of winning a secondary school, which is a mechanical result: the first stage of the probability to win a scholarship on average year of education is close to one year. For women, the IV point estimate suggests that one year of education increase women's earning by 236 GHS in

Table 5: Returns to one extra year of education (after JHS): experimental, observational, and Weighted-DML estimates

	Total earnings (6 mo, 2022 GHS)					Wage employed				
	(1) IV GYS, full	(2) OLS GYS, ctrl	(3) W.DML GYS, ctrl	(4) OLS AHIES	(5) OLS GYS ctrl, wage-emp	(6) IV GYS, full	(7) OLS GYS, ctrl	(8) W.DML GYS, ctrl	(9) OLS AHIES	(10) OLS Census
Panel A: All										
Years of education	181.9	242.1***	281.5***	484.9***	408.9***	0.056***	0.042***	0.045***	0.048***	0.064***
	(124.5)	(47.2)	(42.9)	(72.0)	(87.1)	(0.018)	(0.006)	(0.006)	(0.004)	(0.000)
Comparison mean (JHS only)	2156.2	2224.0	2222.6	5458.9	4413.6	0.250	0.257	0.256	0.146	0.165
Observations	1,698	1,110	1,078	577	342	1,731	1,139	1,127	2,185	200,181
Panel B: Female										
Years of education	236.1*	320.3***	359.8***	666.8***	662.8***	0.061***	0.057***	0.058***	0.060***	0.078***
	(135.8)	(59.1)	(52.5)	(111.9)	(100.5)	(0.021)	(0.008)	(0.008)	(0.005)	(0.001)
Comparison mean (JHS only)	1327.6	1349.1	1351.0	3258.2	2990.6	0.148	0.148	0.149	0.084	0.090
Observations	858	566	563	217	127	868	576	572	1,083	95,318
Panel C: Male										
Years of education	110.1	175.6**	198.2***	375.6***	291.2**	0.051*	0.027***	0.032***	0.038***	0.052***
	(219.3)	(73.0)	(66.7)	(91.7)	(117.2)	(0.030)	(0.008)	(0.009)	(0.006)	(0.001)
Comparison mean (JHS only)	3324.9	3380.4	3426.1	6377.4	5066.5	0.393	0.401	0.404	0.223	0.253
Observations	840	544	533	360	215	863	563	548	1,102	104,863
p-value (Male = Female, levels)	0.686	0.140	0.057	0.007	0.022	0.828	0.007	0.037	0.005	0.000
p-value (Male = Female, %-effect)	0.273	0.000	0.000	0.000	0.000	0.099	0.000	0.000	0.000	0.000

Notes: GYS (Ghana Youth Study) is the longitudinal data collected by the authors from the experimental sample; AHIES (Annual Household Income and Expenditure Survey) is the nationally representative survey produced by the Ghana Statistical Service; Census refers to the 2021 Ghana Population and Housing Census. Outcomes are total six-month earnings (2022, Ghana cedis, trimmed at the 99th percentile in columns 1–5) and a wage-employment indicator. Column 1 is 2SLS using the scholarship lottery as instrument on the full GYS sample; column 2 is OLS within the GYS control group; column 3 is Weighted Double Machine Learning (Chernozhukov et al., 2018) within the control group; column 4 is OLS on AHIES respondents aged 27–32 who completed JHS. AHIES respondents born in Greater Accra are excluded from the sample, to make the sample more comparable to the GYS sample. We use the GYS 2022 round to match the AHIES 2022 round. Column 5 is OLS within the GYS control group restricted to wage earners — apples-to-apples with AHIES, since AHIES observes earnings only for the wage-employed. Columns 6–9 mirror 1–4 for the wage-employed outcome; column 10 is OLS on Census 2021 respondents aged 27–32 who completed JHS, weighted by sampling weights. All specifications control for region and, in the pooled-sample (Panel A) regressions, for gender. The IV columns additionally control for baseline BECE score and BECE year (an indicator for whether the respondent sat the 2007 BECE); OLS, DML, AHIES, and Census specifications omit these BECE controls to remain comparable to AHIES, which does not collect baseline BECE scores. For OLS specifications, the comparison group is respondents who never enrolled in SHS. The bottom two rows test equality of the female and male coefficients in levels and as a percentage of the comparison-group mean.

2022 (or 18% of the control group mean, significant at the 10% level only), while for men each year of education increase wages by 110 GHS (the estimate is insignificant, though with large standard errors, and we cannot reject equality with the estimate for women).

The main goal of this table is to compare these estimates with the OLS estimates of the return per year of education beyond junior high school. In column (2), we see that the OLS estimate is in the same ballpark as the IV both for men and for women, with point estimates for women that are about twice the magnitude as those for men. Although the gender difference in treatment effects is not statistically significant in levels (even in the more precise OLS specification), it is very significant in percentage terms.

In column (3), we exploit our very rich baseline to control for observables using the double

machine learning technique in (Chernozhukov et al., 2018), weighted to reflect the sample of compliers. The estimate is, if anything, a little larger than the standard OLS.

Column (4) runs the same estimate using the nationally representative AHIES survey (for wage earners with non-zero earnings in the last month). Not surprisingly, the level effect is larger (485 GHS in the full sample), but the sample mean is also considerably larger, so that the percentage increase is in the same ballpark as the other estimates (the AHIES point estimate translates to a 9% increase, against 8% for the IV estimate and 10% for the OLS in the control group sample). Much as in our data, the returns to education appears about twice as large for women as for men in level, and the sample in the AHIES is large enough that the difference is statistically significant. Finally, in column (5), we run an estimate that is more directly comparable to the AHIES, which is an OLS estimate focusing on wage-employed worker who reported positive earnings last month. The sample becomes quite small, but the patterns are broadly in line with those observed in the representative sample.[23]

In columns (6) to (10) of Table 5, we report estimates of the impact per year of education beyond junior high school on the probability of working for a wage (as opposed to being self employed or not earning any income; we show the results specifically for public sector employment in Table A5). The estimates are very consistent across samples and specifications. For men and women combined, each year of education increases the probability of working for a wage by 5.6 percentage points in our IV specification (which represents about 25% of the control means), 4.2 percentage points in the OLS in our control group, 4.8 percentage points in the AHIES, and 6.4 percentage points in the census. The estimates are larger for women than for men (e.g, 5.7 percentage points vs 2.7 percentage points in the OLS in our control group), and the gender differences are generally statistically significant.

In general, getting estimates of the returns to education is difficult because collecting good earnings data is difficult in contexts where the vast majority of workers are informally employed or self-employed. 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

[23]The sectoral shift in the experimental sample is also consistent with observational data. Figure B3 shows that, in the nationally representative sample, completing SHS is associated primarily with a movement out of non-agricultural self-employment and informal non-agricultural sector and into both public employment and formal high-skill private jobs. This sectoral shift leads to gains in earnings. For both genders, and whether people come from urban or rural areas, the largest returns to SHS education are within the public sector (Figure B4). These patterns suggest that returns outside the public sector do exist, but are small relative to the substantial public-sector premia.

subject to measurement error (de Mel et al., 2009) and somewhat skewed.[24] Yet, our analyses make clear that collecting earnings data for all is a necessary step. When the data is just missing, like in the AHIES, a large part of the labor market story for these young people is missing, and returns are overestimated in levels.

6.3 Detailed labor market trajectories

A benefit of our long follow up is the ability to trace earnings and returns to education over time. Figure 2 shows estimated treatment effects on total earnings, for each survey year. OLS estimates of the return to one year of education are presented as well, since we saw in subsection 6.2 that the OLS and IV estimates are generally similar.

For women, the treatment effect increases in magnitude from 2017 to 2020; it becomes statistically significant in 2020, and stays fairly stable afterwards, around 200 GHS or about 20% -30% of average earnings.

For men, the effects of education appear later and remain smaller throughout. The treatment effect of winning the scholarship never gets significant, although it has large standard errors so it is hard to draw firm conclusions. Interestingly, even the OLS point estimate is essentially zero until 2019. In 2020, it increases to 111 GHS (OR 6% of the average earnings, much lower in percentage terms than for women), and stays around that level until 2023.[25] The OLS estimate of one year of education tells a similar story, with point estimates that are generally quite close to the effect of winning the scholarship.[26]

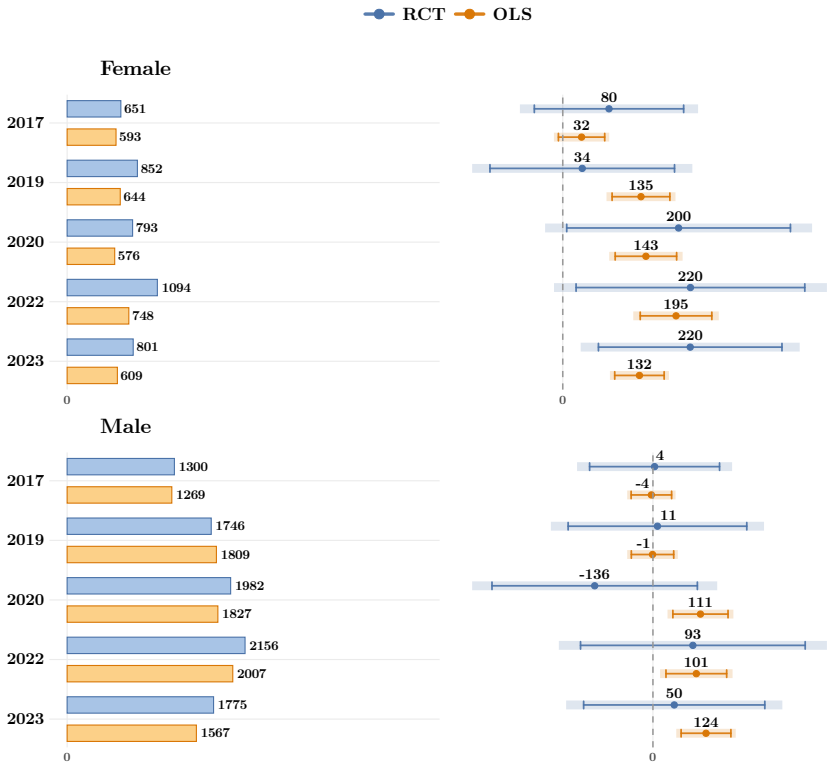
Job search strategies Our rich data also allows us to observe the job search process. Among those who have a job, scholarship winners were much less satisfied with it as of 2019: there is a negative treatment effect of -0.195 on a scale that ranges from 1 to 5 (p-value=0.01, Table A6).

[24] Table B8 shows summary statistics on earnings by sector and we describe how earnings were measured in Appendix B.1.

[25] Figure B2 shows extensive margin effects on earnings and public sector employment over time, and Figure B5 documents the public sector premium.

[26] The government of Ghana adopted strict measures in response to COVID-19 on March 15, 2020, closing schools, banning all social gatherings, and closing international borders. Schools did not re-open until January 2021. We completed a COVID-focused survey round between May and September 2020. The results from this round are shown in Table B9. Among women, scholarship winners do much better than scholarship non-winners. They are more likely to have a wage contract with an employer and less likely to be self-employed. They have higher and less volatile earnings. We see a particularly large gap in earnings in April, the month most affected by the introduction of severe COVID-19 related restrictions. We see no treatment effect for men in 2020, except in the probability of being self-employed.

Figure 2: Total (real) earnings in the last 6 months: treatment effects over time



Notes: Earnings expressed in 2017 Ghana cedis, deflated using Ghana Statistical Service June CPI (regional where available, Ghana national otherwise), trimmed above the 99th percentile of the pooled (female+male) distribution within each survey wave. Individuals with zero earnings are included. For each panel: the left half shows control-group mean earnings — blue is the full control group (denominator for the RCT effect), orange is the subset with zero years of SHS in 2017 (denominator for the OLS per-year return). The right half shows the RCT treatment effect (blue) and the OLS per-year-of-education return in the control group (orange), with 90% CIs as whiskers and 95% CIs as the ends of the lighter line.

Scholarship winners were not more confident they could get a better job, but significantly more likely than non-winners to be actively looking for a job, whether or not they were currently employed, suggesting that they maintained higher aspirations (Table A6).

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 (Table A6). These attempts often fail, however. As of 2023, the share living in a big city is only 12.6% for women and 13.7% for men, 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 27%) 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? 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.

6.4 Does education create discontent? Experimental impacts on self-reported satisfaction

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 youths anticipated at baseline. Returns to education in this context seem to fall far short of perceived returns to education. This result is consistent with a recent literature showing over-optimism on the continent: Abebe et al. (2025) in Ethiopia, Banerjee and Sequeira (2023) in South Africa, and Bandiera et al. (2025) in Uganda.

Over time, study participants' expectations for the job their *children* can attain if they reach primary school are much more realistic than their own expectation when they graduated, with no difference between treatment and control groups (Table B10). This suggests that society as a whole has revised downwards their expectations, likely due to the fact that there are now many more (unemployed) graduates around.[27]

If getting access to secondary education changes aspirations but those are not realized, does it lead to frustration? Table 6 shows impacts of the scholarship on mental health in 2013, as well as on (dis)satisfaction in both 2013 and 2023. In the sample as a whole, we do not see any differences in mental health levels and satisfaction, but this masks a very striking heterogeneity between men and women. In 2013, female scholarship recipients have 0.12 standard deviation higher level of satisfaction compared to their counterparts, while among males there is a 0.12 standard deviation *lower* level of satisfaction among male scholarship recipients. This gap in treatment effect persists to 2023, with female scholarship winners significantly less likely to be dissatisfied with their finances, ability to improve their lives and life overall, and male scholarship winners significantly more likely to be dissatisfied with their life overall.

These results are striking. Since men experience less positive impacts, but still positive overall, they are likely to come from the frustration they experience as their aspirations are not met, while

[27] By 2022, three cohorts of students had completed SHS under the free SHS policy launched in 2017.

women much more clearly experience a positive trajectory.

Table 6: Mental Health and Satisfaction

	2013		2023				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Mental health index (higher = better)	**Satisf. index (higher = better)**	Dissatisfied with HH finance	Unable to change one's life	Life not as good as others	Dissatisfied with life overall	**Satisf. index (higher = better)**
Panel A: All							
Treatment	0.015	-0.008	-0.005	-0.019	0.002	0.005	0.034
	(0.046)	(0.047)	(0.026)	(0.016)	(0.022)	(0.024)	(0.052)
P-value	0.744	0.862	0.840	0.236	0.931	0.844	0.519
Step-down p-val	1.000	1.000	1.000	0.816	1.000	1.000	0.981
Comparison mean	0.000	-0.000	0.549	0.114	0.228	0.290	0.000
N	1981	1981	1656	1652	1646	1656	1657
Panel B: Female							
Treatment	0.005	0.115*	-0.067*	-0.046**	0.000	-0.059*	0.178**
	(0.064)	(0.066)	(0.037)	(0.022)	(0.031)	(0.033)	(0.075)
P-value	0.937	0.079	0.070	0.039	0.997	0.076	0.019
Step-down p-val	0.999	0.273	0.273	0.225	0.999	0.273	0.093
Comparison mean	-0.043	-0.042	0.581	0.130	0.222	0.313	-0.063
N	1001	1001	832	830	826	833	833
Panel C: Male							
Treatment	0.025	-0.125*	0.055	0.008	0.004	0.066**	-0.106
	(0.066)	(0.068)	(0.036)	(0.022)	(0.031)	(0.034)	(0.073)
P-value	0.704	0.066	0.127	0.731	0.901	0.049	0.144
Step-down p-val	0.972	0.265	0.426	0.972	0.972	0.223	0.426
Comparison mean	0.045	0.043	0.515	0.097	0.234	0.266	0.066
N	980	980	824	822	820	823	824
P-val male=fem	0.900	0.011	0.018	0.074	0.974	0.010	0.007

Notes: See Table 1 Notes. The satisfaction indices in columns 2 (2013) and 7 (2023) are inverse-covariance-weighted summary indices (Anderson, 2008) of the underlying satisfaction items, standardized using the control group mean and standard deviation, so coefficients are expressed in control-group standard deviations and *higher values denote greater overall satisfaction*. Both indices aggregate the same four items: life satisfaction, life-as-good, household finances, and feasibility of changing one's life. The outcomes in columns 3–6 are binary indicators equal to one if the respondent reported being "very dissatisfied" or "dissatisfied" on the corresponding 1–5 Likert (or "cannot change" / "probably cannot change" on the 1–4 scale in column 4). Treatment effects on job dissatisfaction (asked only of the employed / wage-employed) are reported separately in Table A6. The mental health index in column 1 is constructed by the same method over seven 2013 items: whether in the past few days the respondent was bothered by unbothersome things, had trouble concentrating, was depressed, felt everything was an effort, was hopeful about the future, was fearful, or was restless.

7 From experiment to policy: Effects of Ghana's 2017 free SHS reform

The experimental estimates from our RCT capture the partial-equilibrium returns to secondary education in an environment where peers did not also receive free schooling, and where the supply of tertiary spots and skilled jobs remained fixed. To shed light on the aggregate, general-equilibrium effects of expanding secondary school access, we complement the experimental evidence with a quasi-experimental analysis of Ghana's 2017 Free SHS policy. Because the reform removed fees universally and abruptly, following a campaign promise of the incoming government, it provides a sharp source of variation in the cost of secondary education that is plausibly exogenous to individual-level determinants of educational attainment.

Data We measure the impact of the reform using three complementary data sources. For enrollment counts, we draw on administrative records from Ghana's Education Management Information System (EMIS), obtained from the Ghana Ministry of Education, which provide annual first-year SHS enrollment totals from 2013 through 2019. To capture changes in attainment in the broader population, we use three rounds of nationally representative household surveys that straddle the reform: the Ghana Living Standards Survey (GLSS, 2005 and 2012), the Population and Housing Census (2010 and 2021), and the Annual Household Income and Expenditures Survey (AHIES panel, 2022–2024).

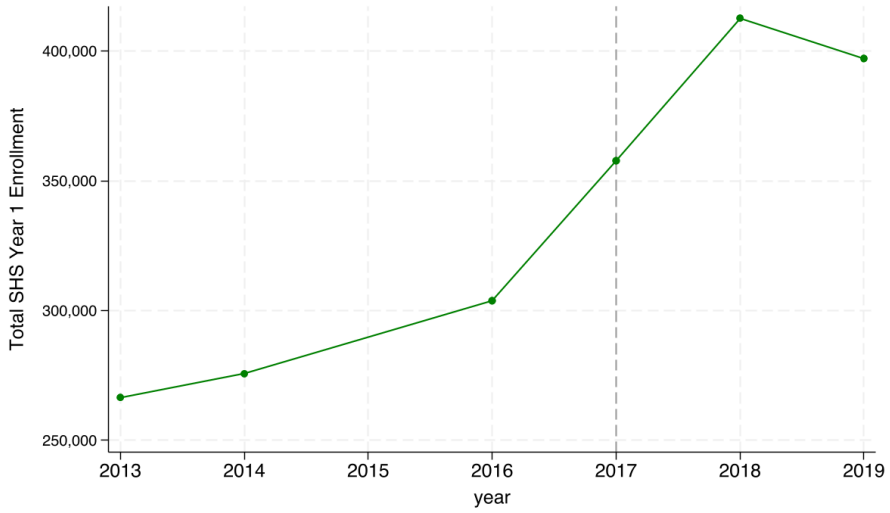
7.1 Impacts on Secondary Education

Figure 3 documents a large and immediate increase in secondary school enrollment following the reform. Panel (a) shows that total first-year SHS enrollment rose from approximately 305,000 in 2016 to 355,000 in 2017 (the first cohort to benefit from free tuition), and reached nearly 413,000 by 2018, representing a 35 percent increase over the pre-reform level. Panel (b) shows that the increase in enrollment translated into a substantial rise in secondary attainment in the population. Among 16-21 year-olds, the share who ever attended SHS hovered around 0.33–0.34 for both men and women in the years leading up to the reform (GLSS 2012 and 2017). By the time of the first post-reform population census (2021), these shares had risen to 0.50 for men and 0.52 for women, a gain of roughly 17-19 percentage points, or around 50%. This increase is larger than what the

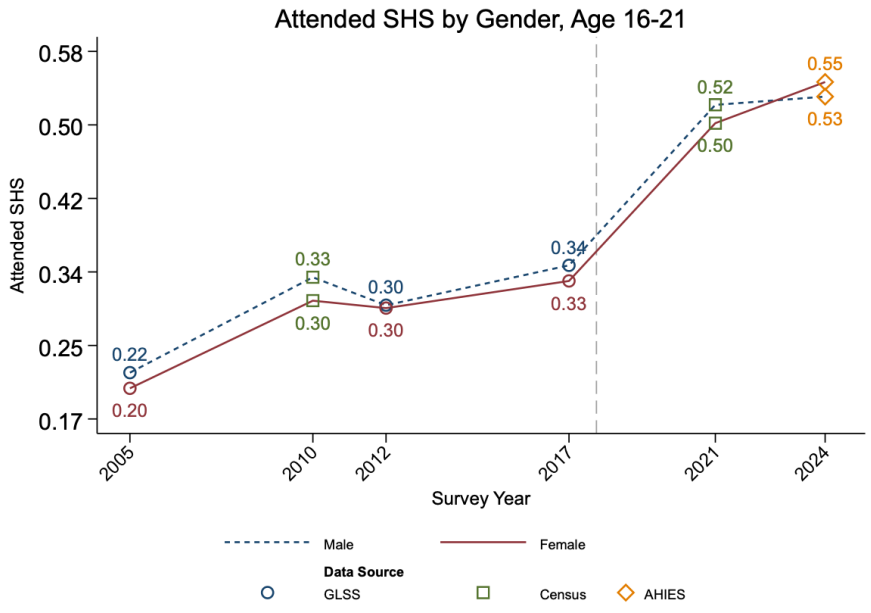
model in Fujimoto et al. (2023) predicts (24%). Survey data from AHIES (2024) show attendance rates at 53-55%, suggesting the reform produced a persistent, large-scale expansion in secondary schooling. The convergence in attainment rates between men and women is also notable: the gender gap closes in the post-reform period.

Figure 3: Impact of Ghana's 2017 Free SHS Policy on Enrollment in SHS

(a) Total Enrollment, First Year of SHS (from administrative EMIS data source)



(b) Share ever attended SHS (from secondary survey data sources)



Notes: Free SHS was implemented in 2017. Data sources: (a) EMIS at the Ghana Ministry of Education; (b) Annual Household Income and Expenditures Survey (AHIES, 2024), Census of Ghana (2010, 2021), and Ghana Living Standards Survey (GLSS, 2005, 2012, 2017). Panel (a) shows the total number of students enrolled in the first year of SHS, by year. Panel (b) shows the share ever attended SHS in age group 16-21, across cohorts. In Panel (b), marker shapes indicate the data source (circles: GLSS; squares: Census; diamonds: AHIES).

Taken together, these findings confirm that the removal of fees had a first-order effect on the supply of secondary school graduates in Ghana. In the short term, the general equilibrium impacts of a large cohort of new secondary school graduates depend primarily on two factors: the number of available slots in tertiary education, and the capacity of the private sector to absorb these new students.

7.2 Impacts on Tertiary Education

One possible bottleneck given the large increase in secondary education, and strong desire of secondary school graduates to pursue through tertiary education, would have been the fixed number of slots in university. In our experiment, we saw graduates wait for a long time until they could get a spot.

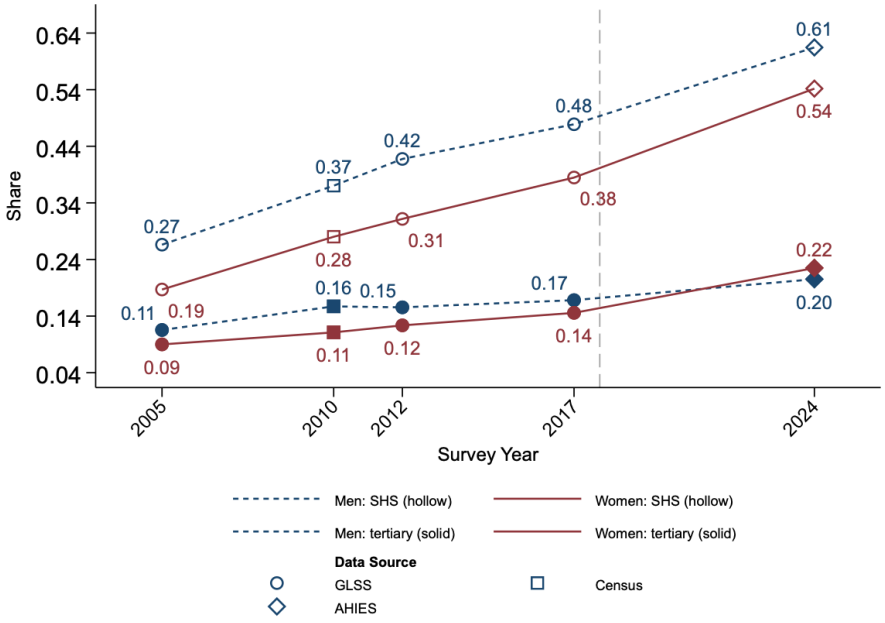
The Ghana government actually expanded the number of available seats right around the time of the implementation of the Free SHS policy in the 2017/2018 cycle. First, allowances for Teacher college trainees were reintroduced, with no quota, meaning anyone could enroll and get paid (provided they qualified), creating a surge in enrollment; second, there was a significant expansion of admissions at public universities.[28] Due to this expansion of slots, the admission rate did not decrease in response to the free SHS policy (Figure B6a). What's more, consistent with the results in our experiment, we find that the gender gap in the admission rates, and in admissions (Figure B6b), completely closes *after* the free SHS policy is put in place, indicating that the marginal women able to graduate from SHS thanks to the free SHS policy may be of higher ability than the marginal men.

Using the same approach as for SHS attendance, we combine all available nationally representative surveys to look at tertiary attendance across cohorts for a given age group. We focus on the age group 21-25: in the latest survey available (AHIES 2024), this age group corresponds to the cohort that was 14-18 at the time free SHS started and thus was directly impacted by the reform in terms of their own educational attainment. Consistent with the descriptive evidence mentioned above regarding the expansion of tertiary options around the time of the free SHS reform, Figure 4 shows an increase in tertiary enrollment between 2017 and

[28]This expansion of tertiary options at the same time as free SHS means that the cohort that had just finished SHS at the time benefited from a relatively high admission rate before the surge in new SHS graduates adjusted down the ratio of tertiary slots to SHS graduates. The admission rate again increased sharply in 2023 when the University of Ghana expanded its regional campuses to offer regular degrees (and not only continuing education programs as before).

2024 for women, proportional to the increase in SHS completion rates. For men we do not see a trend break in tertiary enrollment growth after the SHS reform, consistent with our experimental results.

Figure 4: SHS completion and tertiary attendance before and after the 2017 Free SHS policy, by gender



Notes: Sample: individuals aged 21–25, pooled across nationally representative surveys (GLSS 2005, 2012, 2017; Census of Ghana 2010; AHIES 2024). Hollow markers show the share who completed SHS; solid markers show the share who ever attended tertiary education. Marker shapes indicate the data source: circles for GLSS, squares for the Census of Ghana, and diamonds for AHIES. The vertical dashed gray line marks the Free SHS reform.

7.3 Impacts on the Labor Market

Nationally representative datasets can also be used to trace the trajectory of key variables after the introduction of free SHS. Of course, the free SHS reform is less than 10 years old, so few working-age individuals in nationally representative surveys are young enough to have been affected. Nevertheless, we can study a few key outcomes across cohorts for the age group 21-25, which was directly impacted by the reform in terms of their own educational attainment.[29]

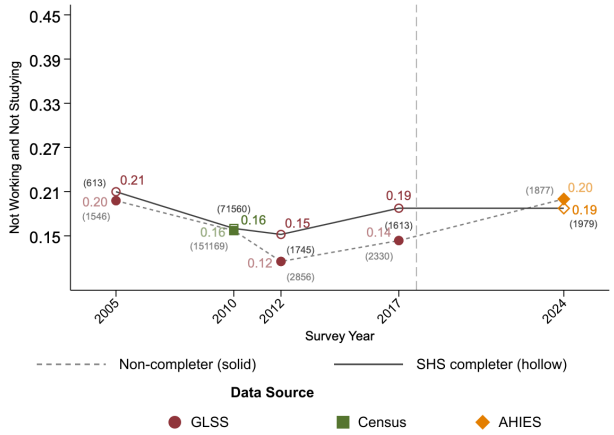
To study potential indirect impacts onto older cohorts, we study labor market outcomes over time for the birth cohort 1970-1985: those were 32–47 years old at the time of the reform, thus

[29]The impact of the reform on SHS completion among that age group is documented in Figure 4: the percentage of 21 to 25 year-old men who completed SHS was 48% in 2017 (GLSS), and rose to 61% by 2024 (AHIES). Among women in that age group, the share rose from 38% to 54% over that time period.

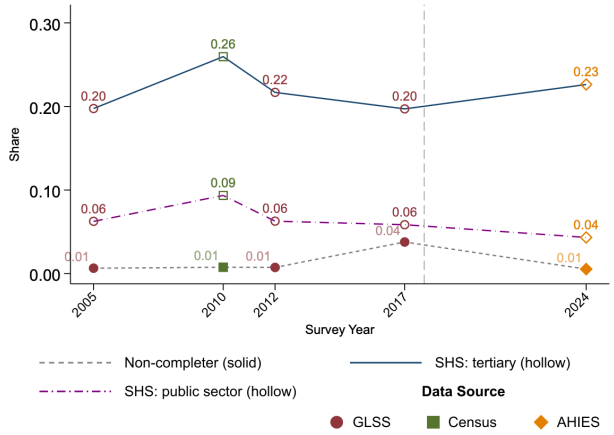
already settled in the labor market yet far enough from retirement, and possibly indirectly impacted through an influx of secondary school graduates in the labor market. (Figure B7 shows how the share of SHS graduates among the adult population aged 18-55 increased over time and in response to the reform.)

Figure 5: Labor Market Outcomes by SHS Completion Status, 21–25 Age Group, Over time

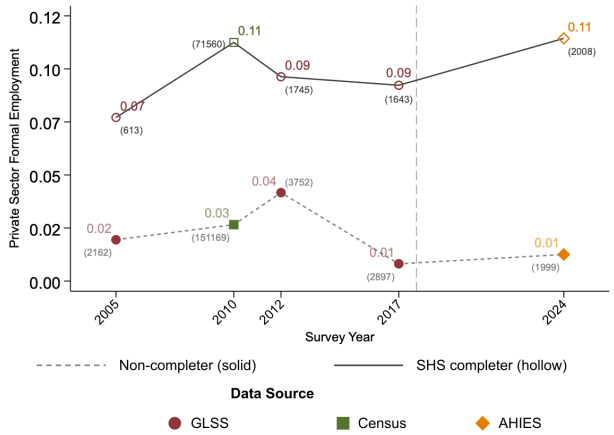
(a) Not working and Not studying



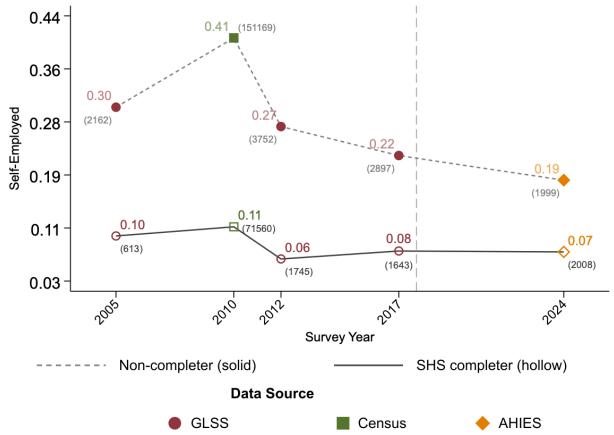
(b) Currently in Tertiary or Public Sector



(c) Private Sector Formal Employment



(d) Self-Employed



Notes: Figures show mean outcomes by SHS completion status for individuals aged 21–25 who completed at least primary education. Solid markers indicate individuals who did not complete SHS; hollow markers indicate SHS completers. Marker shapes indicate the data source: circles for GLSS (2005, 2012, 2017), squares for the Census of Ghana (2010), and diamonds for AHIES (2024). In Panels (a), (c), and (d), short-dashed lines show non-completers and solid lines show completers. In Panel (b), the solid line shows SHS completers currently in tertiary, the dash-dot line shows SHS completers in public-sector employment, and the short-dashed line shows the pooled outcome for non-completers. Uses sample weights where available.

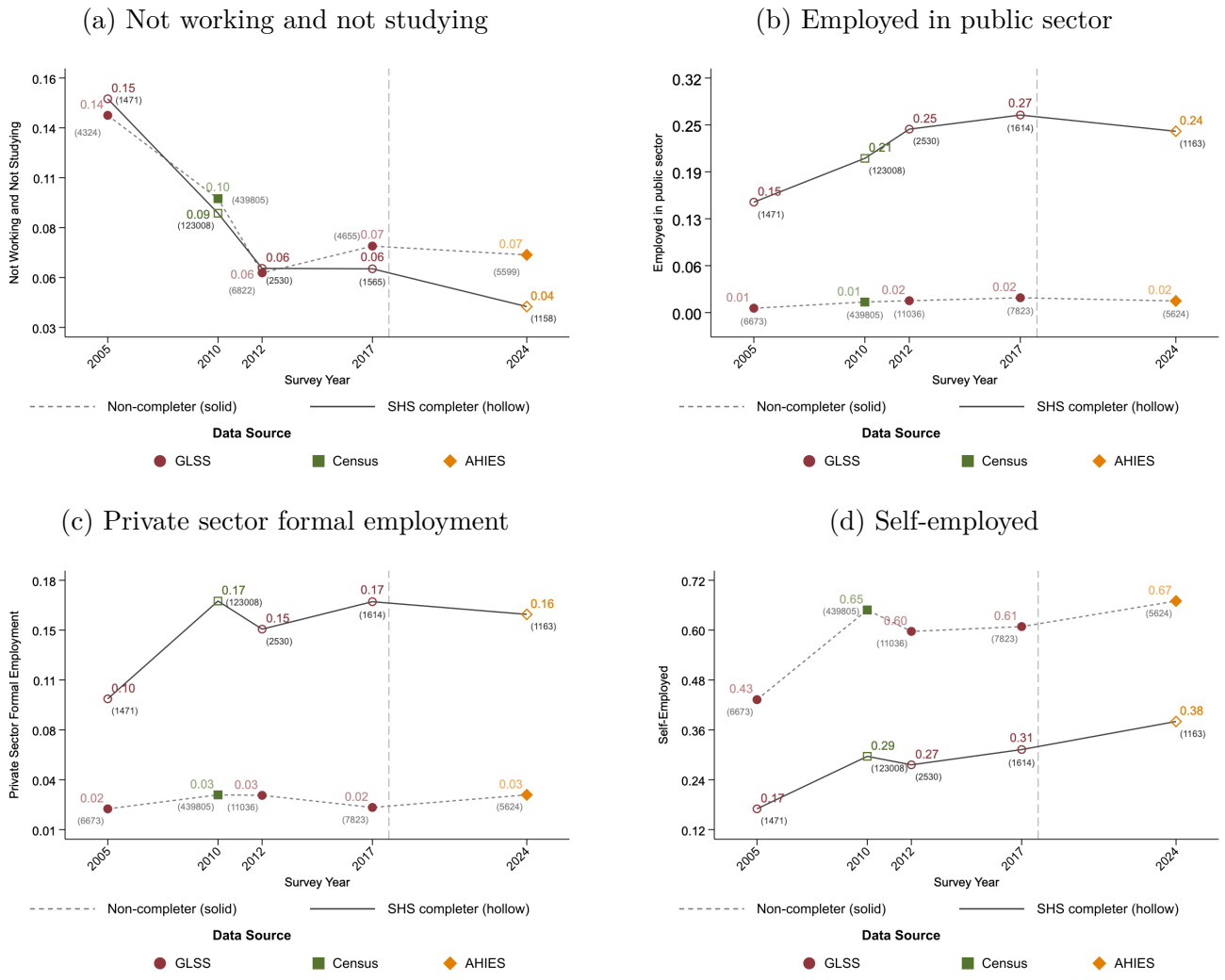
Labor market entry of affected cohort The labor market outcomes by cohort and by SHS graduation status for age group 21—25 are shown in Figure 5. We do not see much of a change

between the cohorts too old to be affected by the reform (21-25 before 2017) and those affected by the reform (21-25 in the 2024 AHIES survey). Even though the share of SHS graduates for the last cohort is much higher after the reform, there appears to be no change in the labor market outcomes of SHS graduates (and of those of non graduates). In particular, there is no change in the odds of being neither working nor studying for SHS graduates (a proxy for queuing, panel a). There is also no decline (if anything, there is a slight increase) in the likelihood that SHS graduates are enrolled in tertiary (panel b), and in the likelihood of being formally employed in the private sector (panel c). This suggests that the tertiary education sector and the private sector were able to absorb the new graduates. There is, however, a 2 percentage points (33%) decline in the likelihood of being publicly employed (panel b), consistent with the fact that public sector employment would not adjust to the number of SHS graduates. Looking at the composition of formal private sector employment across survey years in Figure B8, the first cohort directly affected by the policy (21-25 in 2024) seems to have been disproportionately absorbed by the manufacturing and construction sectors.

The breakdown by gender shown in Figure B9 indicates that female SHS graduates in the post-reform cohort (21-25 in 2024) have relatively better labor market outcomes than their male counterparts. In particular, they are relatively more likely to be employed in the formal private sector, and less likely to be neither working nor studying. This is consistent with our experimental findings that *marginal* women (those whose education is impacted by the free SHS policy) have higher returns than marginal men.

Effects on older cohorts To study equilibrium effects, and abstract from selection effects of who joins secondary school after the reform, we estimate possible spillovers to an older cohort, whose education was completed before the reform. We focus on those born between 1970 and 1985: they were 32 to 47 years old at the time of the reform, and are 39-54 in the latest available survey (2024), i.e., pre-retirement. We plot labor market outcomes separately for SHS graduates and non-graduates in this birth cohort across survey years in Figure 6. We see very stable outcomes for that cohort between the pre-reform and post-reform period, meaning that the influx of new graduates after 2017 did not displace those older workers, be they SHS graduates or not. In particular, there is no change in the share not working, no decrease in formal private sector employment, and only a small increase in self-employment.

Figure 6: Indirect effects of the SHS reform: Labor market outcomes for the 1970–1985 birth cohort, by SHS completion



Notes: Sample restricted to the 1970–1985 birth cohort (aged 20–35 in 2005, 25–40 in 2010, 27–42 in 2012, 32–47 in 2017, and 39–54 in 2024). Solid lines with hollow markers show SHS completers; short-dashed lines with solid markers show non-completers. Marker shapes indicate the data source: circles for GLSS, squares for the Census of Ghana, and diamonds for AHIES. The vertical dashed gray line marks the 2017 Free SHS reform.

Overall, we see no drastic change in the tertiary education or labor market outcomes of secondary school graduates, either new or old, despite the large influx of secondary school graduates. This is different from what Khanna (2023) and Duflo (2004) found in India and Indonesia. This could be because it is too early to see any impact, as the new graduates are still to enter the labor market in large numbers; or because the economy adjusted. It could also be because the formal labor markets play a very small role in the labor market outcomes of these graduates.

8 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 exploiting detailed outcomes data collected over 15 years, we identify the partial equilibrium impact of free secondary education. We find that scholarships increase secondary school completion rates by 28 percentage points, impart significant learning gains and increase tertiary education from 12% to 23% among women. Gains are typically larger for women than for men in percentage terms. This likely reflects unequal investment by gender within the household in some families: if women are generally more likely to stay out of the labor market due to social norms around child rearing, when school is expensive, a credit constrained family who can only afford to send one child to school may choose the boy, even when his probability of continuing into tertiary is low. In our latest round of data, only 63% of women in the control group have earned anything in the last 6 months, compared to 88% of control group men. Consistent with this, enrollment rates absent scholarships are lower for girls, and we find that the marginal boys (those induced to complete SHS by the scholarship) do not succeed in qualifying for tertiary education and government jobs, while the marginal girls do.

While scholarships increased the probability of enrolling in tertiary education and obtaining a public sector job for women, the overall fraction of secondary school graduates attending tertiary education remains fairly low in our sample. Few secondary school graduates have met their ambition of becoming teachers or entering other occupations requiring tertiary education and commanding high rents. 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 had been able to carry those plans out. Those who did enroll often spent several years waiting for a place. 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). Ultimately, the gap between aspirations and reality leads to dissatisfaction among male scholarship winners. This is in sharp contrast with the increase in satisfaction that we see among female scholarship recipients.

Likely as a result of the protracted transition into the labor market, 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 in 2020, and

those grow to 30% by our last followup in 2023, 15 years after the onset of the study. 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. If education and experience are complementary, as in Yamauchi (2004), effects on lifetime income will exceed medium-run effects.

Nevertheless, the experimental data alone is not enough to rule out that any private labor market gains from education are at the expense of others (if education mainly help graduates get access to a rationed job). If this were the case, then a policy that expands access to SHS for all may not result in large productivity gains unless new jobs are created to absorb the influx of graduates. We turn to secondary data sources, namely, we assemble nationally representative surveys conducted between 2005 and 2024, to conduct synthetic cohort analyses of the (short term) impact of Ghana's 2017 Free SHS Policy. We show that the policy led to a very large increase in secondary school attainment, and, since it was accompanied with an expansion in tertiary opportunities, it did not, in the years that immediately followed, generate a skills glut. The private sector seems to have been able to absorb graduates at the same rate despite their surge.

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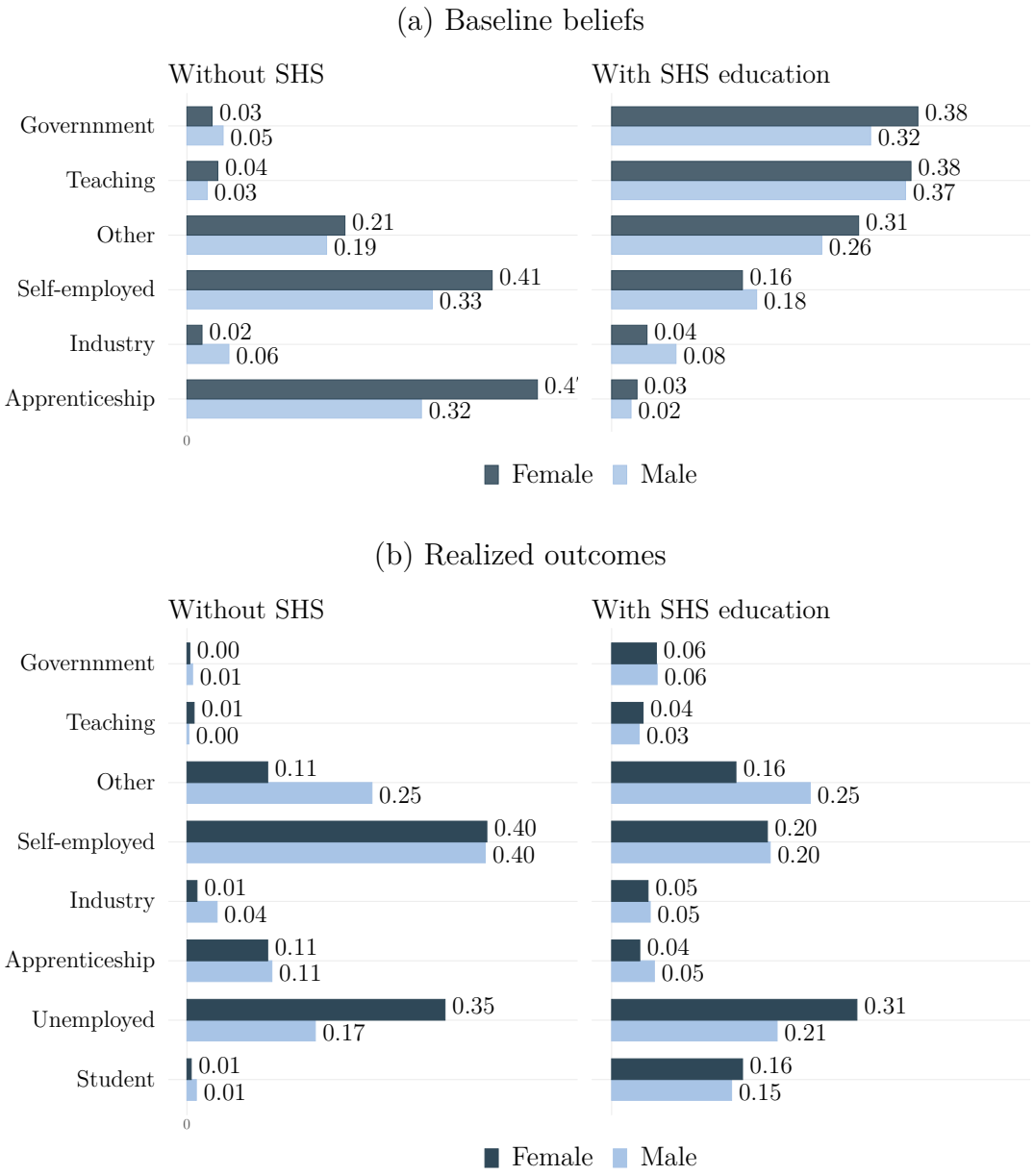
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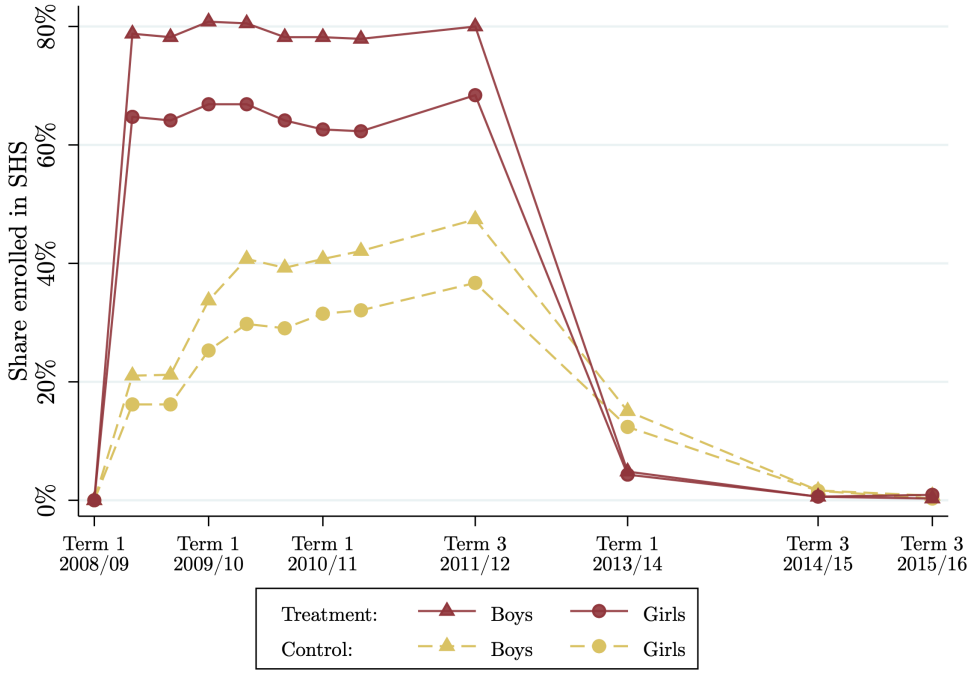
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Figure A1: Type of work by education level: Expectations vs. realizations



Notes: **Panel (a):** Data from the 2008 in-person baseline survey. Respondents (average age 17) were asked: "If you never attend SHS or pursue higher education, what work do you expect to do at 25?" and: "If you complete SHS, what work do you expect to do at 25?" 30% of respondents provided multiple answers. Overall, about 65% of females and 60% of males with SHS education mentioned Government or Teaching as their realized job outcome at age 25 in contrast with being Unemployed or Self-employed as the most likely outcome with no SHS education (responses are non-mutually exclusive).
Panel (b): Data from the 2017 phone follow-up. Realized outcomes shown separately for those who did and did not complete SHS. Responses are disaggregated by gender, pooling treatment and control groups.

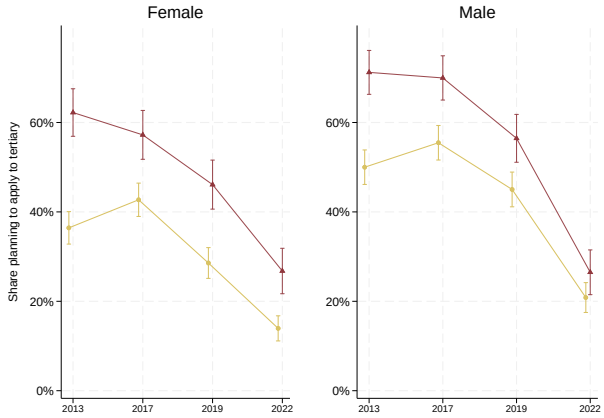
Figure A2: SHS enrollment over time, by treatment status



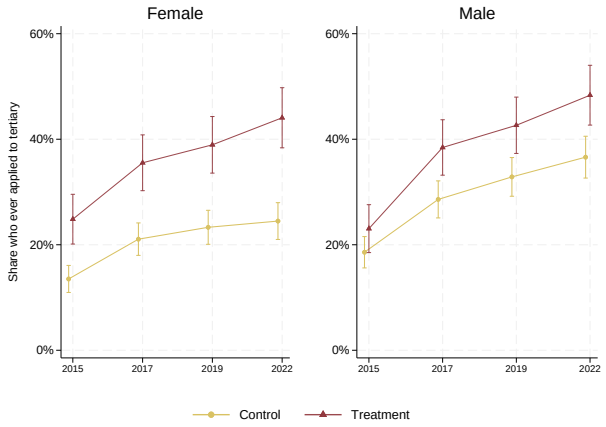
Notes: Data from yearly phone surveys. The scholarships were awarded at the beginning of Term 2 of the 2008/2009 academic year.

Figure A3: Tertiary education: plans and attempts over time

(a) Planning to apply to tertiary education



(b) Ever applied to tertiary



(c) Ever enrolled in tertiary

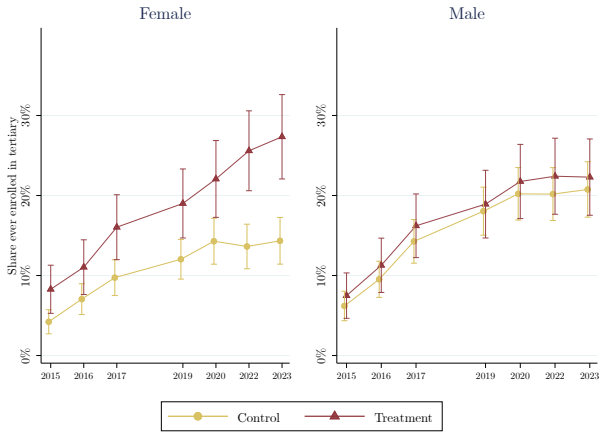
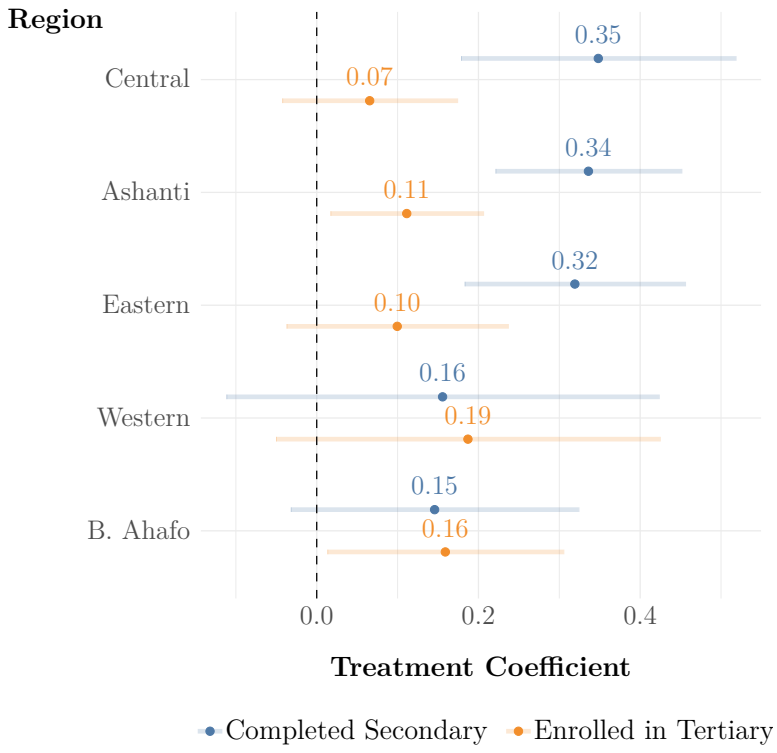


Figure A4: Treatment Effects by Region: Secondary Completion and Tertiary Enrollment by 2023 (Women only)



Notes: Sample restricted to women interviewed in 2023. The secondary completion rate among the control group is 30% (Central), 32% (Ashanti), 44% (Eastern), 50%, (B. Ahafo), and 46% (Western). The tertiary enrollment rate among the control group is 6% (Central), 12% (Ashanti), 22% (Eastern), 10% (B. Ahafo), and 15% (Western).

Table A1: 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	-0.070	0.002	0.009	-0.095	0.011	0.001	15.968	20.863
	(0.071)	(0.004)	(0.023)	(0.109)	(0.023)	(0.018)	(28.047)	(21.181)
P-value	0.326	0.574	0.711	0.382	0.648	0.967	0.569	0.325
Step-down p-val	0.949	0.980	0.980	0.949	0.980	0.980	0.980	0.949
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	-0.075	-0.001	-0.030	-0.127	0.020	0.002	37.541	19.129
	(0.094)	(0.005)	(0.033)	(0.145)	(0.033)	(0.025)	(39.808)	(26.745)
P-value	0.422	0.871	0.366	0.381	0.548	0.950	0.346	0.475
Step-down p-val	0.951	0.981	0.951	0.951	0.951	0.981	0.951	0.951
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
Step-down p-val	0.951	0.951	0.718	0.986	1.000	1.000	1.000	0.951
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). Perceived returns to SHS (column 7) is based on the questions "If you complete Senior High School, what do you think you would make in a month at 25 years old?" and "If you never go to SHS or continue any other higher education in the future, how much money do you think you would make in one month when you are 25 years old?". 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 A2: Tertiary application, admission and enrollment by type

	(1) University	(2) Nursing College	(3) Teaching College	(4) Other professional institution	(5) Polytechnic
Panel A: Female					
Application					
Treatment	0.072***	0.106***	0.077***	0.019*	0.021*
	(0.024)	(0.026)	(0.023)	(0.010)	(0.011)
P-value	0.003	0.000	0.001	0.066	0.073
Comparison mean	0.084	0.090	0.072	0.009	0.014
Admission					
Treatment	0.056**	0.053***	0.050**	0.016	0.012
	(0.022)	(0.020)	(0.020)	(0.010)	(0.010)
P-value	0.011	0.009	0.012	0.113	0.229
Comparison mean	0.072	0.056	0.051	0.009	0.012
Enrollment					
Treatment	0.045**	0.029*	0.027*	-0.004	0.003
	(0.019)	(0.017)	(0.016)	(0.003)	(0.007)
P-value	0.019	0.090	0.097	0.159	0.687
Comparison mean	0.051	0.043	0.039	0.003	0.009
Panel B: Male					
Application					
Treatment	0.050*	0.008	0.069***	0.010	-0.026*
	(0.029)	(0.015)	(0.024)	(0.012)	(0.015)
P-value	0.088	0.583	0.005	0.395	0.091
Comparison mean	0.174	0.042	0.090	0.023	0.065
Admission					
Treatment	0.040	0.012	0.053**	0.014	-0.029**
	(0.028)	(0.012)	(0.020)	(0.012)	(0.013)
P-value	0.149	0.306	0.010	0.256	0.029
Comparison mean	0.153	0.023	0.056	0.019	0.055
Enrollment					
Treatment	0.007	0.009	0.017	-0.000	-0.024**
	(0.024)	(0.010)	(0.016)	(0.006)	(0.011)
P-value	0.776	0.378	0.287	0.984	0.026
Comparison mean	0.123	0.016	0.046	0.009	0.039
P-values treatment male = treatment female					
Application	0.615	0.001	0.870	0.722	0.016
Admission	0.731	0.062	0.858	0.940	0.015
Enrollment	0.247	0.258	0.722	0.575	0.061

Notes: Column (1) includes public and private universities. Column (4) includes public and private institutions for journalism, government secretariat, and accounting.

Table A3: Conditional tertiary admission and enrollment by type

	(1) University	(2) Nursing College	(3) Teaching College	(4) Other professional institution	(5) Polytechnic
Panel A: Female					
Admission conditional on application					
Treatment	-0.047	-0.071	-0.076	-0.333	-0.273
	(0.080)	(0.090)	(0.103)	(0.348)	(0.203)
P-value	0.556	0.433	0.462	0.393	0.209
Comparison mean	0.857	0.623	0.714	1.000	0.875
N	94	110	85	13	18
Enrollment conditional on admission					
Treatment	0.053	-0.062	-0.107	0.000	-0.157
	(0.101)	(0.113)	(0.125)	(0.000)	(0.149)
P-value	0.601	0.585	0.397	0.483	0.330
Comparison mean	0.714	0.758	0.767	0.400	0.571
N	79	65	59	12	14
Panel B: Male					
Admission conditional on application					
Treatment	-0.023	0.219	0.077	0.143	-0.136
	(0.053)	(0.181)	(0.097)	(0.125)	(0.159)
P-value	0.671	0.234	0.429	0.269	0.396
Comparison mean	0.879	0.542	0.627	0.846	0.838
N	167	39	99	24	49
Enrollment conditional on admission					
Treatment	-0.101	0.044	-0.223*	-0.178	-0.134
	(0.076)	(0.356)	(0.113)	(0.244)	(0.216)
P-value	0.189	0.902	0.054	0.478	0.542
Comparison mean	0.793	0.692	0.812	0.364	0.710
N	146	23	65	22	39
P-values treatment male = treatment female					
Admission	0.868	0.196	0.307	0.124	0.616
Enrollment	0.211	0.556	0.403	0.855	0.912
Estimated total cost of program (GHC, 2017)					
	11,875	11,500	8,900	6,916	12,950

Notes: Column (1) includes public and private universities. Column (4) includes public and private institutions for journalism, government secretariat, and accounting.

Table A4: Returns to Secondary Education: OLS Estimates (Control Group)

	(1)	(2)	(3)
	Total earnings in the last 6 mo.		
	2017	2019	2023
Panel A: All			
Standardized cognitive score (2013)	3.4	99.6*	471.7***
	(38.3)	(58.4)	(118.5)
P-value	0.928	0.088	0.000
Comparison mean	881.1	1120.0	2240.3
Effect size (%)	0.4	8.9	21.1
N	1236	1234	1041
Panel B: Female			
Standardized cognitive score (2013)	50.5	226.9***	395.7***
	(36.9)	(61.2)	(110.4)
P-value	0.171	0.000	0.000
Comparison mean	837.4	648.9	1694.3
Effect size (%)	6.0	35.0	23.4
N	638	636	540
Panel C: Male			
Standardized cognitive score (2013)	-53.0	-78.7	571.1**
	(74.1)	(108.3)	(238.2)
P-value	0.474	0.467	0.017
Comparison mean	935.8	1685.3	2828.2
Effect size (%)	-5.7	-4.7	20.2
N	598	598	501
P-val male=fem	0.420	0.023	0.532

Notes: Sample restricted to control group (scholarship non-winners). The dependent variable is total earnings over the last 6 months and trimmed at the 99th percentile. All regressions control for region fixed effects, baseline BECE mean score (with a missing-score indicator), and an indicator for the 2007 BECE cohort; the pooled "All" column additionally controls for gender.

Table A5: Returns to one extra year of education (after JHS): public-sector employment

	(1) IV (2SLS) GYS, full	(2) OLS GYS, control	(3) Weighted DML GYS, control	(4) OLS AHIES 30–35	(5) OLS Census 30–35
Panel A: All					
Years of education	0.029***	0.040***	0.045***	0.055***	0.059***
	(0.011)	(0.004)	(0.004)	(0.003)	(0.000)
Comparison mean (JHS only)	0.009	0.011	0.011	0.036	0.009
Observations	1,727	1,136	1,123	2,066	179,206
Panel B: Female					
Years of education	0.048***	0.040***	0.045***	0.059***	0.064***
	(0.014)	(0.006)	(0.005)	(0.005)	(0.001)
Comparison mean (JHS only)	0.005	0.006	0.006	0.037	0.005
Observations	868	576	572	1,059	82,110
Panel C: Male					
Years of education	0.007	0.040***	0.045***	0.050***	0.054***
	(0.018)	(0.006)	(0.006)	(0.004)	(0.000)
Comparison mean (JHS only)	0.015	0.017	0.017	0.036	0.012
Observations	859	560	551	1,007	97,096
p-value (Male = Female, levels)	0.069	0.996	0.928	0.211	0.000
p-value (Male = Female, %-effect)	0.004	0.000	0.000	0.315	0.000

Notes: Outcome is a binary indicator for public-sector employment. See Table 5 Notes for column definitions, controls, and the comparison-group construction. As in Table 5, the IV column additionally controls for baseline BECE score and BECE year (an indicator for whether the respondent sat the 2007 BECE); OLS, DML, AHIES, and Census specifications omit these BECE controls to stay comparable to AHIES.

Table A6: Job search

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	If employed: dissatisfied with job (2019)	If employed: confident can get a better job (2019)	Actively searching for job (2019)	If has earnings: actively searching for a job (2019)	If employed: dissatisfied with job (2022)	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	0.037	0.008	0.074***	0.093***	0.043**	0.051**	-0.016	-0.027
	(0.025)	(0.014)	(0.022)	(0.027)	(0.020)	(0.025)	(0.017)	(0.030)
P-value	0.136	0.553	0.001	0.001	0.035	0.039	0.350	0.369
Step-down p-val	0.432	0.737	0.005	0.005	0.167	0.188	0.737	0.737
Comparison mean	0.211	0.933	0.242	0.197	0.125	0.344	0.132	0.286
N	1286	1287	1952	1172	1386	1657	1632	890
Panel B: Female								
Treatment	0.020	0.012	0.085***	0.144***	0.017	-0.010	-0.023	-0.053
	(0.038)	(0.022)	(0.030)	(0.039)	(0.028)	(0.033)	(0.023)	(0.043)
P-value	0.595	0.599	0.004	0.000	0.549	0.764	0.328	0.220
Step-down p-val	0.946	0.946	0.018	0.001	0.946	0.946	0.855	0.751
Comparison mean	0.217	0.930	0.198	0.115	0.114	0.286	0.126	0.253
N	541	542	986	482	626	833	821	402
Panel C: Male								
Treatment	0.050	0.006	0.062*	0.054	0.066**	0.110***	-0.009	-0.010
	(0.033)	(0.018)	(0.032)	(0.037)	(0.029)	(0.036)	(0.025)	(0.042)
P-value	0.126	0.750	0.051	0.140	0.023	0.002	0.717	0.814
Step-down p-val	0.464	0.978	0.245	0.464	0.111	0.020	0.978	0.978
Comparison mean	0.207	0.935	0.288	0.254	0.135	0.405	0.137	0.314
N	745	745	966	690	760	824	811	488
P-val male=fem	0.547	0.871	0.613	0.082	0.276	0.015	0.699	0.536

Notes: See Table 1 notes. Column 1 is a binary indicator equal to one if the respondent reported being "very unsatisfied" or "unsatisfied" (the bottom two categories of a 1–5 scale) with his/her job in 2019; restricted to those employed at the time of the survey. Column 2 is a binary indicator equal to one if the respondent reported being "confident" or "very confident" (the top two categories of a 1–5 scale) that they could get a better job in 2019; restricted to those employed. Column 5 mirrors column 1 for the 2022 wave (we use 2022 rather than 2023 because the 2023 wave routed the job-satisfaction question only to wage-employed respondents).

Online Appendix

Appendix B.1 Earnings Measurement

General earnings

The callback surveys carried out from 2017 to 2023 measure the respondents' income earned as follows. The survey asks a sequence of questions related to occupation and income for all 6 months leading up to the survey. The first question is 'Did you work during the month [relevant month]?' If the answer is yes, the survey asks the number of activities the respondent carried out in that month. Then, the survey asks questions on the category of the activities (e.g., service), specific job (e.g. trader), and employment type (e.g., self-employed). Since a respondent can report multiple activities per month, the survey allows to select multiple options for these questions as well.

Finally, the survey asks the respondent for their total income earned during the month for all activities combined, and the value of total in-kind payments earned. For the income questions, a hint next to the question specifies that the respondent should report the income that they *should* have earned in the relevant month, in Ghanaian Cedi.

The income measurements used in this paper are the sum of the reported income over the six months before the survey. After the monthly questions, the survey asks for the respondents' primary occupation, and its employment category and employment type. Only one answer is allowed in these questions. The categorization of respondents in different groups for measuring income is based on these variables.

Agricultural earnings

For those indicating their primary occupation is self-employed agriculture, the calculation of earnings follows a different procedure. The 2017 callback includes an extensive agricultural module on farmers production and labor on their own plots as well as plots of others. Using the reported number of busy and off-season months, we calculate, for each respondent, the total hours of agricultural labor in the six months before the survey. Then, we value the quantity of labor at the median reported market price for agricultural labor in the given region, creating an estimate of the value of the respondent's agricultural labor over a six month period.

To estimate earnings for self-employed farmers after 2017, we use the updated information from subsequent callbacks whenever possible. The 2019 and 2022 callbacks contain information on farm ownership and the price of agricultural labor. The 2022 callback also contains questions on the hours of labor on family plots in a given month. For 2020 and 2023, we only correct the earnings for inflation, assuming that, for those whose primary occupation is still agriculture, the quantity of labor is the same as the year before. Missing information is imputed with the median.

Appendix B.2 Additional Figures and Tables

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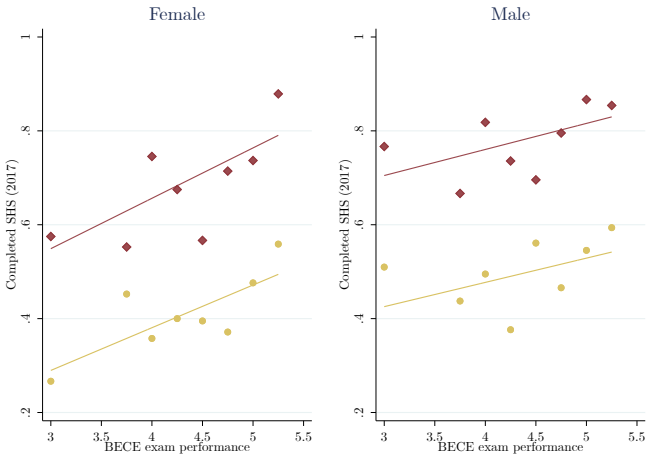
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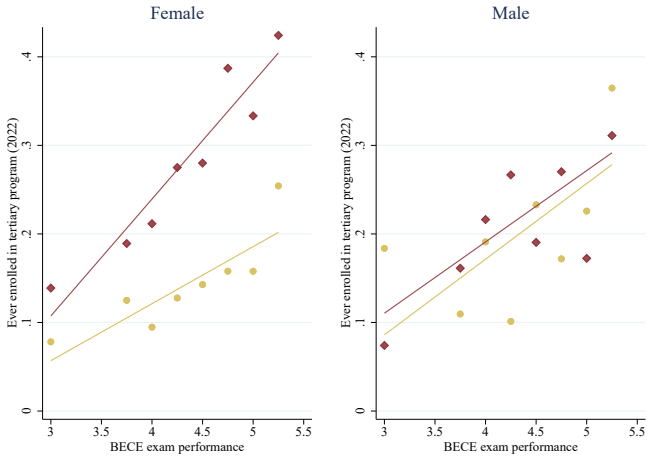
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Figure B1: Impact of scholarship, by baseline score

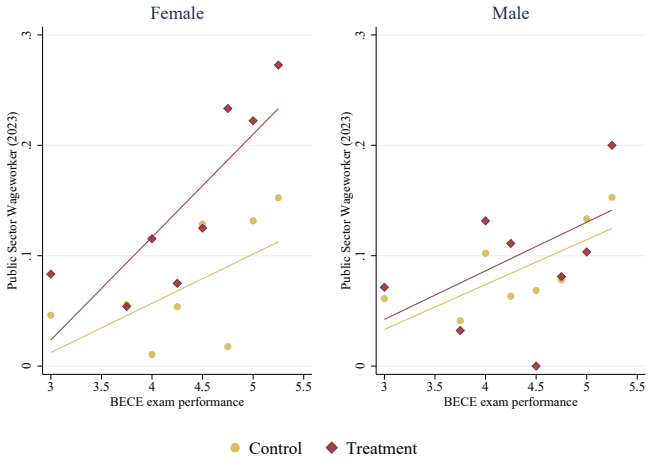
(a) SHS completion



(b) Tertiary Enrollment



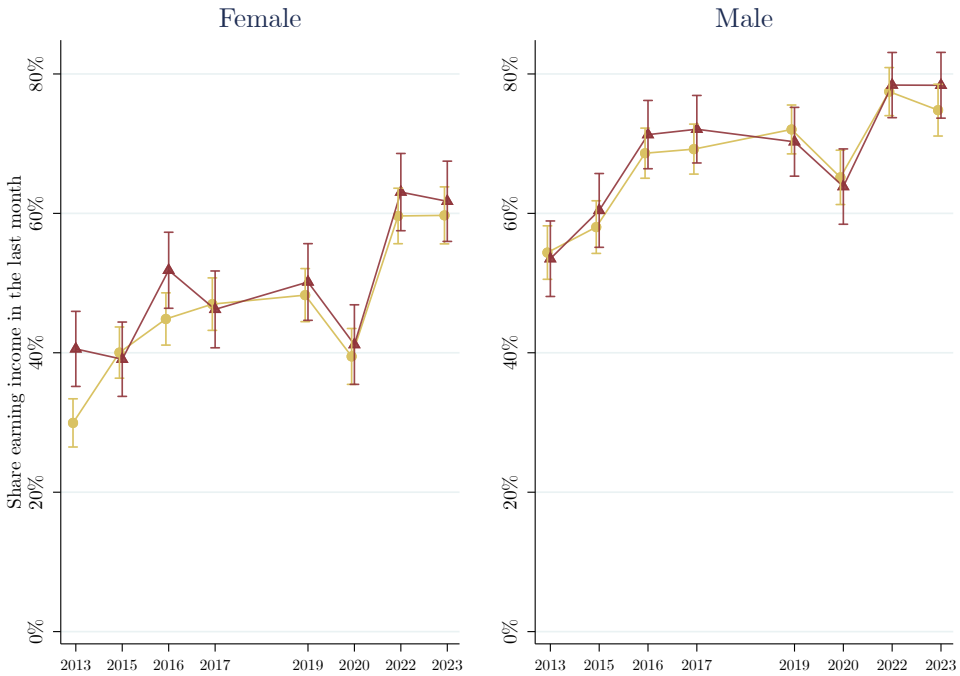
(c) Public sector wage employee (2022)



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 B2: Labor market outcomes over time

(a) Probability of having earned income in the last month



(b) Probability of being a public sector wageworker

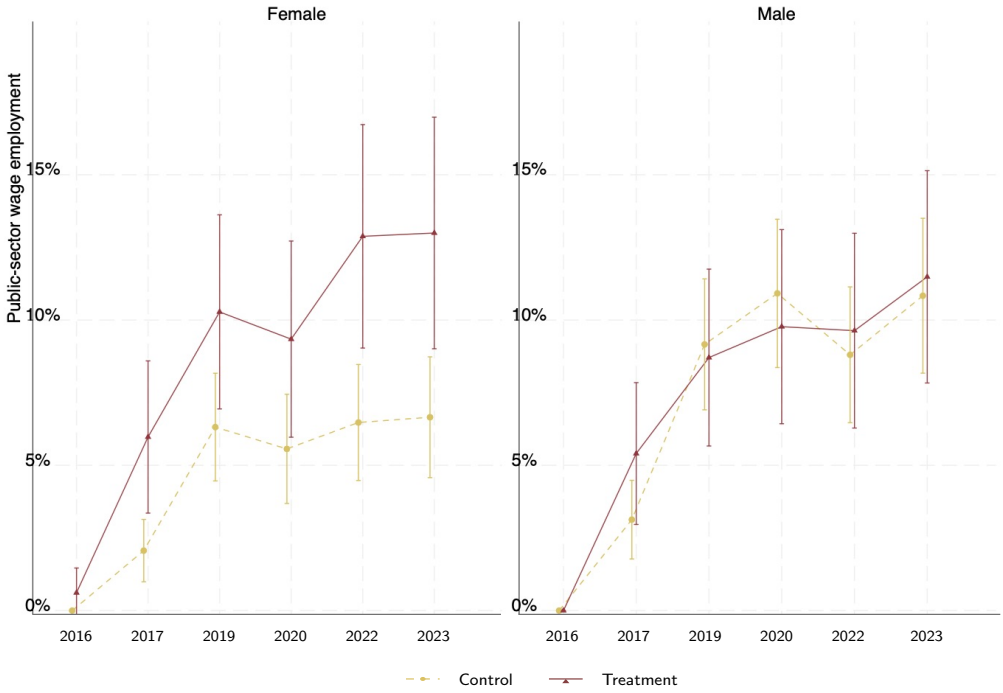
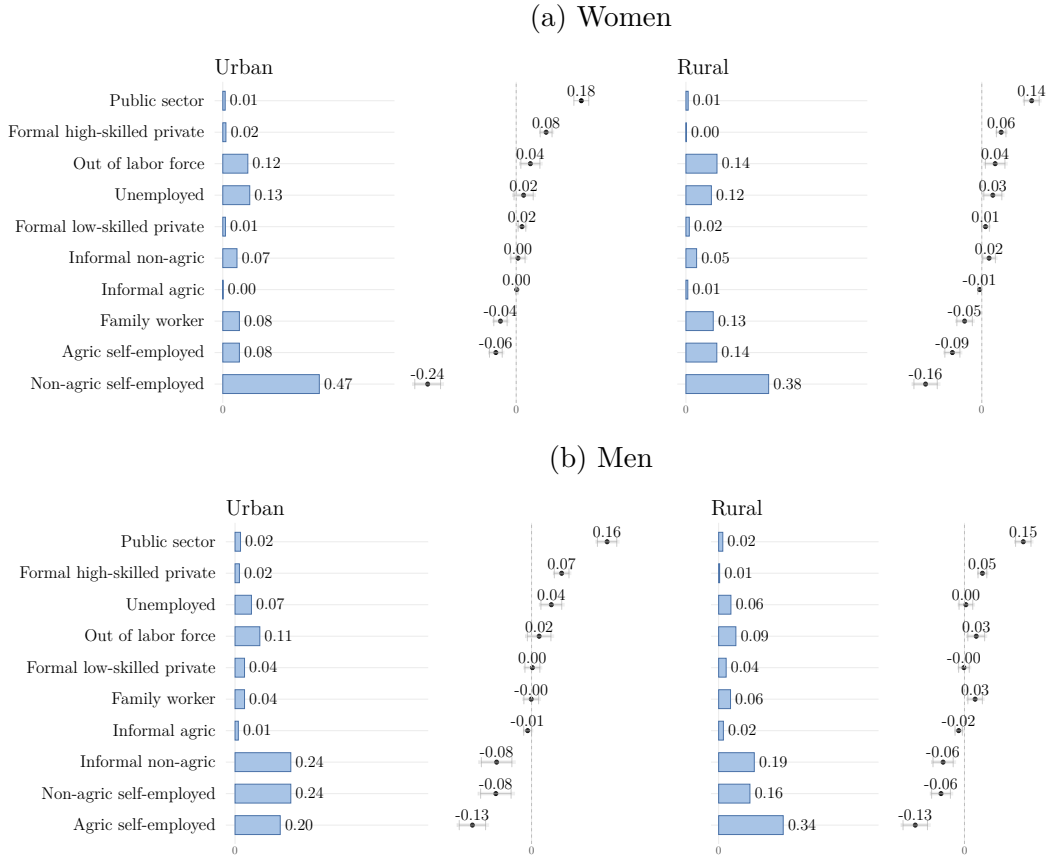
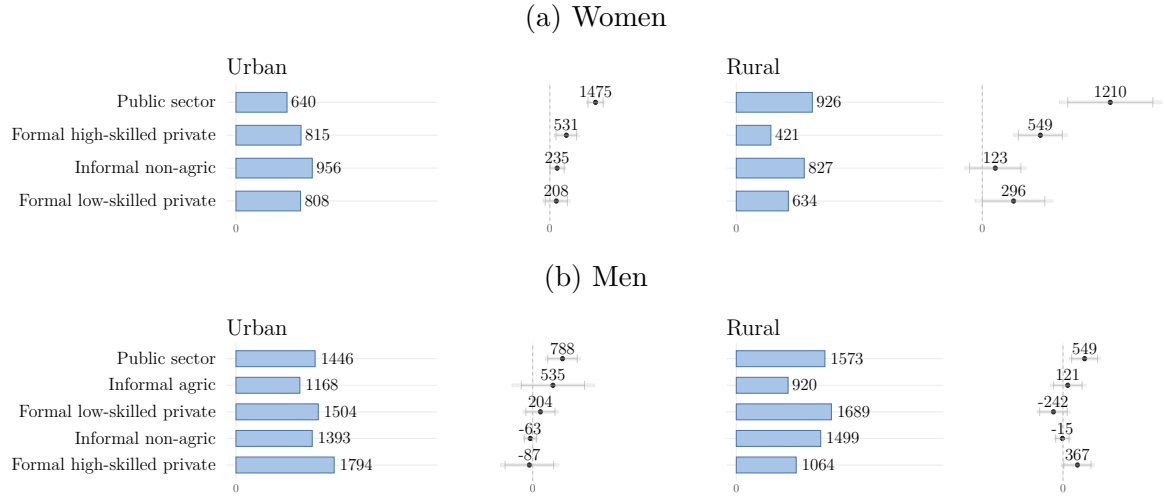


Figure B3: Observational returns to SHS on Sector of occupation



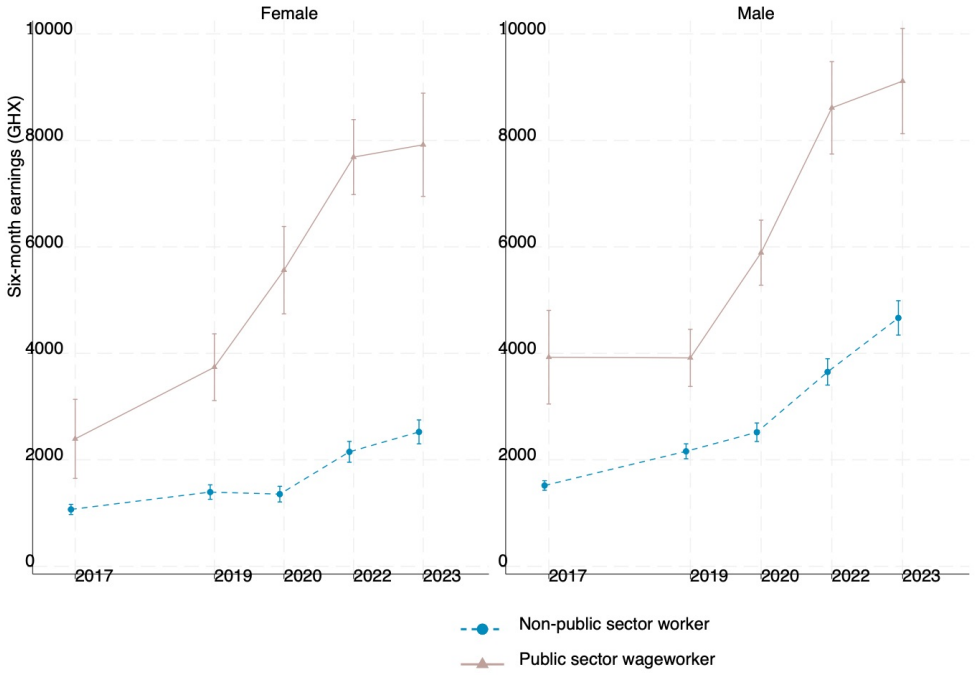
Notes: Data source: AHIES survey (2022-2024). Sample includes those aged 25–45 who completed JHS. Blue bars show means for those with JHS only, and coefficient estimates and associated confidence intervals show OLS estimates of having completed SHS. Estimates use the latest observation available per person in a panel with quarterly data from Q1 2022 to Q4 2024. N = 5,160 unique women and N = 4,979 unique men. Urban-rural classification is based on district where the respondent is born.

Figure B4: Observational returns to SHS on earnings within sector of occupation (among wage earners)



Notes: Data source: AHIES survey (2022-2024). Includes those aged 25–45 who completed JHS and have wage employment. N = 1,725 unique women and N = 2,826 unique men. Estimates use the latest observation available per person in a panel with quarterly data from Q1 2022 to Q4 2024. Urban-rural classification is based on district where the respondent is born. Blue bars show means for those with JHS only, and coefficient estimates and associated confidence intervals show OLS estimates of having completed SHS.

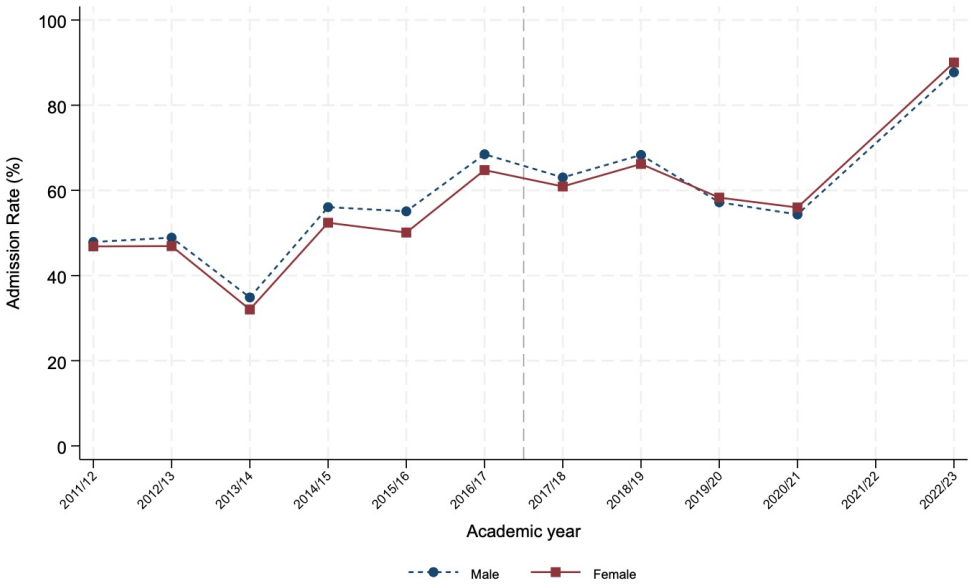
Figure B5: Earnings in the last 6 months, by sector



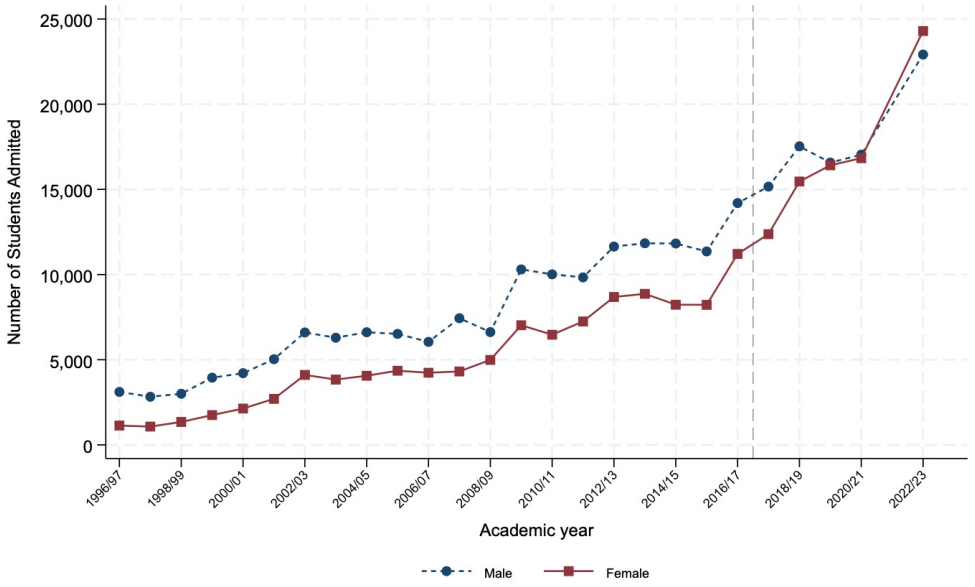
Note: Sample limited to employees. Short-dashed lines with circles show non-public-sector workers; solid lines with triangles show public-sector wageworkers. Whiskers correspond to 95% confidence intervals. Details on how earned income is measured are provided in Appendix B.1. Earnings trimmed at the 99th percentile.

Figure B6: University of Ghana Admission Rates and Admissions Over Time

(a) University of Ghana Admission Rates by Gender

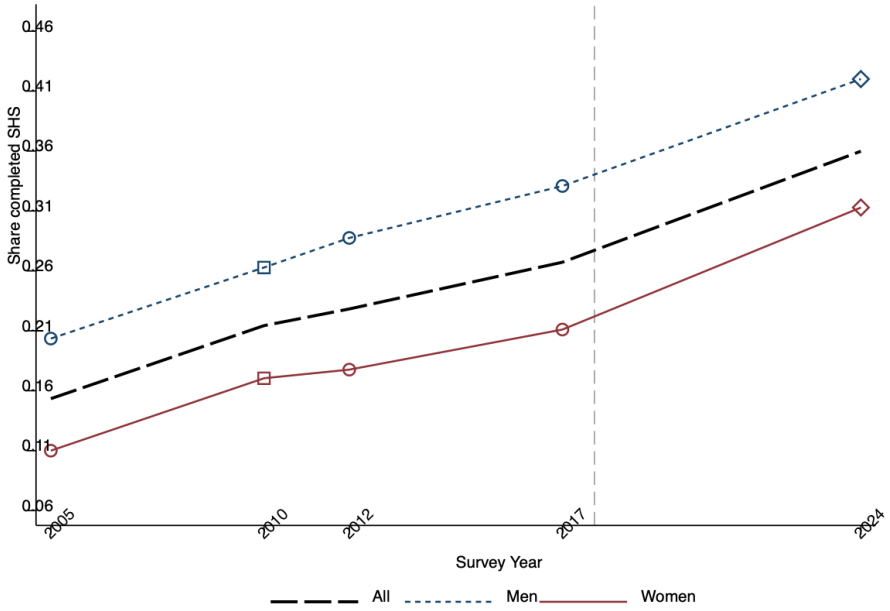


(b) University of Ghana Admissions by Gender



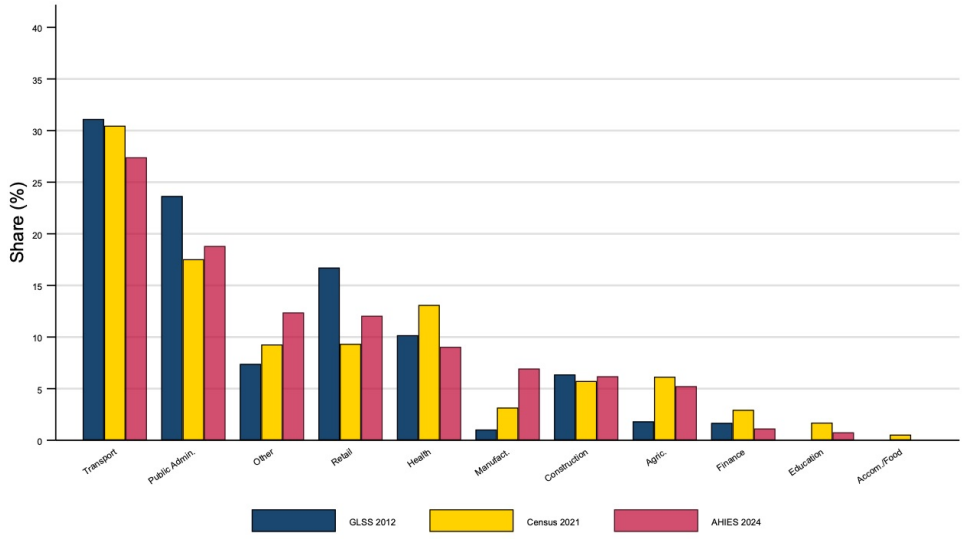
Notes: Data source: Authors' calculations based on reports downloaded from the website https://irpo.ug.edu.gh/, last accessed June 18, 2026. Panel (a) shows the admission rate (admitted/applied) at the University of Ghana separately for male and female applicants for the years the data is available. Panel (b) shows the number of students admitted to the University of Ghana across all programs from 1997 to 2024, separately for male and female students. In both panels, short-dashed lines with circles denote males and solid lines with squares denote females.

Figure B7: Share of SHS graduates in the adult population (ages 18–55), by survey year



Notes: Share of individuals aged 18–55 who completed Senior High School, pooled across data sources (GLSS 2005, 2012, 2017; Census of Ghana 2010; AHIES 2024). Census 2021 and AHIES 2022/2023 are excluded. The long-dashed black line shows the pooled share, the short-dashed navy line shows men, and the solid maroon line shows women. Vertical dashed line marks Ghana's 2017 Free SHS reform. Sample weights used where available.

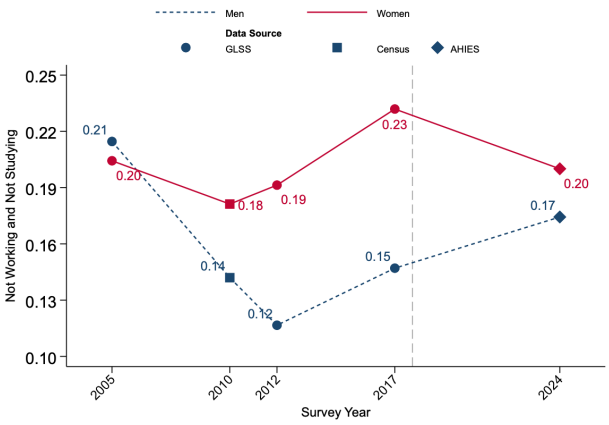
Figure B8: Distribution of private formal jobs among SHS graduates aged 21–25.



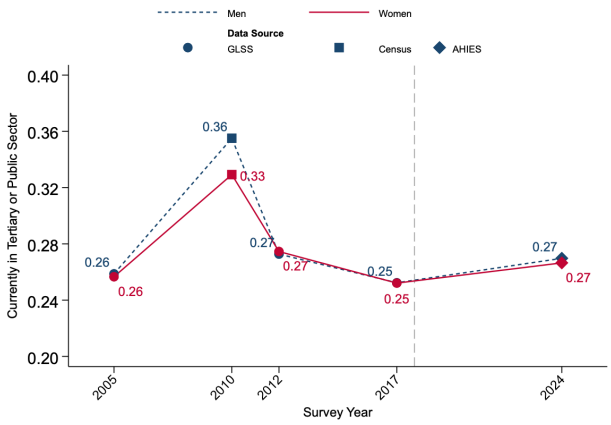
Notes: Data sources: GLSS 2012 (annual cross-section), Census 2021 (10% sample, ∼4 yrs post-reform), AHIES 2024 Q4. GLSS 2017 is omitted because that questionnaire only offered a single "Private Sector" code and cannot distinguish private formal from informal. Sample: completed SHS, wage employee in respondent-reported private-formal sector, age 21–25. Industry groups follow the AHIES 11-category classification: Agriculture, Manufacturing, Construction, Retail/Trade, Transportation, Accommodation/Food Services, Public Administration/Defense, Finance/Insurance (incl. real estate and prof./sci./tech. services), Education, Health, Other. Shares are pop-weighted.

Figure B9: Free SHS Policy: Labor market outcomes for SHS completers aged 21-25, by gender

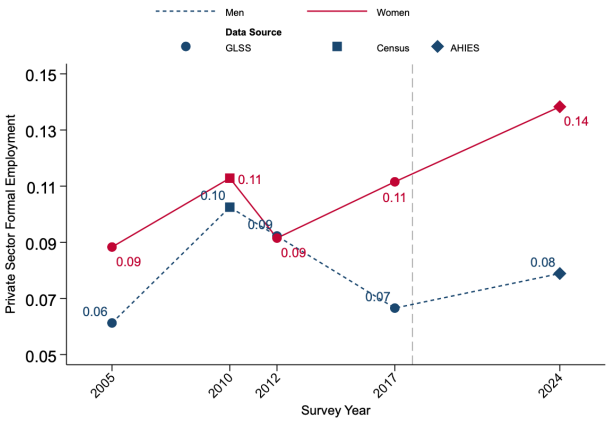
(a) Not working and not studying



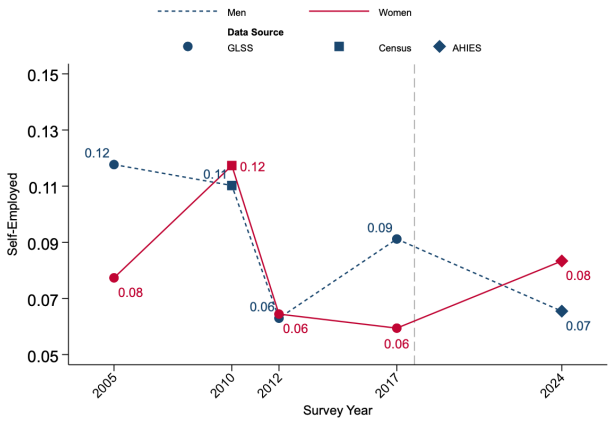
(b) Currently in tertiary or public sector



(c) Private sector formal employment



(d) Self-employed



Notes: Sample restricted to SHS completers aged 21–25. Short-dashed navy lines denote men and solid cranberry lines denote women. Marker shapes indicate the data source: circles for GLSS, squares for the Census of Ghana, and diamonds for AHIES. Series are shown by survey year, pooled across data sources (GLSS 2005, 2012, 2017; Census of Ghana 2010; AHIES 2024). The vertical dashed line marks Ghana's 2017 Free SHS reform. Sample weights are used where available.

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	-5.833***	0.082**	1.015	-1.122	0.014	0.002	-0.003	-81.444***
	(0.947)	(0.035)	(1.364)	(5.910)	(0.024)	(0.021)	(0.013)	(29.485)
P-value	0.000	0.019	0.457	0.849	0.551	0.943	0.839	0.006
Step-down p-val	0.001	0.096	0.899	0.981	0.899	0.981	0.981	0.036
Comparison mean	9.803	0.000	51.077	100.783	0.409	0.258	0.087	804.693
N	1919	1981	1981	1981	1981	1981	1984	1977
Panel B: Female								
Treatment	-4.562***	0.150***	0.393	-2.222	0.009	0.003	-0.009	-74.557*
	(1.105)	(0.048)	(1.968)	(8.097)	(0.033)	(0.030)	(0.018)	(42.180)
P-value	0.000	0.002	0.842	0.784	0.785	0.910	0.637	0.077
Step-down p-val	0.003	0.010	0.999	0.999	0.999	0.999	0.990	0.315
Comparison mean	7.920	-0.044	51.136	99.727	0.400	0.270	0.085	883.759
N	974	1001	1001	1001	1001	1001	1002	998
Panel C: Male								
Treatment	-7.138***	0.012	1.838	0.285	0.018	-0.001	0.004	-88.184**
	(1.538)	(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	0.002	0.997	0.885	1.000	0.975	1.000	0.997	0.199
Comparison mean	11.798	0.047	51.015	101.885	0.418	0.245	0.089	722.464
N	945	980	980	980	980	980	982	979
P-val male=fem	0.164	0.060	0.641	0.851	0.821	0.962	0.662	0.775

Notes: See Table 1 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."

Table B2: Survey rates 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	0.262	0.883	0.046	0.011	0.022	0.002	0.001	0.546
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	0.008	-0.013	0.014	0.045*	0.045**	0.039	-0.017**	0.007
	(0.012)	(0.011)	(0.013)	(0.013)	(0.023)	(0.022)	(0.026)	(0.008)	(0.007)
P-value	0.918	0.473	0.330	0.299	0.054	0.045	0.127	0.031	0.373
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	0.551	0.784	0.129	0.557	0.824	0.594	0.295	0.887	0.679

Notes: See Table 2 notes.

Table B3: 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**	0.005	-0.020**	0.002
	(0.008)	(0.007)	(0.010)	(0.008)
BECE exam performance	-0.009	-0.063	0.287	0.147
	(0.147)	(0.138)	(0.184)	(0.190)
Perceived returns to SHS (%)	-0.035	0.003	-0.058**	-0.013
	(0.025)	(0.021)	(0.026)	(0.025)
Per capita household yearly expenditures	-0.033	-0.021	-0.010	0.033
	(0.031)	(0.022)	(0.034)	(0.036)
Completed SHS (2019)	0.058*	-0.031	-0.020	0.041
	(0.032)	(0.029)	(0.036)	(0.033)
Ever enrolled in tertiary program (2019)	-0.052	-0.019	0.062	-0.049
	(0.045)	(0.032)	(0.057)	(0.042)
Earnings 6mo 2019 (1000s)	0.003	0.017**	0.001	0.009
	(0.009)	(0.008)	(0.010)	(0.008)
Number of children ever had (2019)	0.028**	0.012	-0.019	0.012
	(0.012)	(0.017)	(0.014)	(0.018)
Migrated to different district since 2008 (2016)	0.031	-0.017	0.043	0.001
	(0.028)	(0.027)	(0.032)	(0.032)
Migrated to an urban area (2017)	-0.028	-0.016	-0.025	-0.009
	(0.034)	(0.030)	(0.040)	(0.037)
Migrated abroad (2017)	0.162	0.539***	0.123	0.353***
	(0.140)	(0.126)	(0.121)	(0.136)
Interaction coefficients:				
Age in 2008 x Treat	0.011*	0.002	0.006	0.004
	(0.007)	(0.007)	(0.009)	(0.008)
BECE exam performance x Treat	-0.242	-0.001	0.021	0.046
	(0.187)	(0.203)	(0.268)	(0.233)
Perceived returns to SHS (%) x Treat	0.012	0.024	0.006	0.026
	(0.030)	(0.041)	(0.031)	(0.041)
Per capita household yearly expenditures x Treat	-0.007	-0.016	-0.006	-0.070*
	(0.042)	(0.029)	(0.053)	(0.040)
Completed SHS (2019) x Treat	-0.089*	0.016	-0.077	-0.156**
	(0.051)	(0.056)	(0.063)	(0.062)
Ever enrolled in tertiary program (2019) x Treat	-0.020	0.005	-0.164**	-0.008
	(0.054)	(0.049)	(0.071)	(0.060)
Earnings 6mo 2019 (1000s)$xTreat$	0.010	-0.020*	0.010	-0.005
	(0.013)	(0.011)	(0.017)	(0.012)
Number of children ever had (2019) x Treat	-0.031	0.011	-0.018	-0.025
	(0.021)	(0.030)	(0.025)	(0.029)
Migrated to different district since 2008 (2016) x Treat	0.007	-0.028	-0.091*	-0.002
	(0.043)	(0.045)	(0.052)	(0.046)
Migrated to an urban area (2017) x Treat	-0.009	0.008	0.008	0.067
	(0.054)	(0.049)	(0.065)	(0.057)
Migrated abroad (2017) x Treat	0.056	-0.322	-0.005	0.029
	(0.206)	(0.216)	(0.183)	(0.309)
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 B4: Main outcomes in 2023 with entropy balanced sample

	(1) Ever enrolled in tertiary	(2) Completed tertiary	(3) Self-employed	(4) Public sector employee	(5) Earned income in past 6 months	(6) Total earnings in the last 6 months	(7) Ever migrated to big city to look for a job	(8) Lives in a big city	(9) If SHS: receives help from network to find job
Panel A: All									
Treatment	0.072***	0.064***	-0.069***	0.038**	0.040*	328.696*	0.051**	-0.017	-0.024
	(0.021)	(0.020)	(0.024)	(0.016)	(0.021)	(195.639)	(0.025)	(0.017)	(0.030)
P-value	0.001	0.001	0.004	0.018	0.062	0.093	0.038	0.326	0.421
Step-down p-val	0.002	0.003	0.016	0.065	0.209	0.214	0.153	0.574	0.574
Comparison mean	0.175	0.135	0.393	0.087	0.742	3118.031	0.344	0.132	0.286
N	1662	1662	1657	1655	1637	1637	1657	1632	890
Panel B: Female									
Treatment	0.136***	0.106***	-0.092**	0.067***	0.028	534.358**	-0.010	-0.024	-0.050
	(0.030)	(0.028)	(0.036)	(0.023)	(0.034)	(232.745)	(0.033)	(0.023)	(0.043)
P-value	0.000	0.000	0.012	0.003	0.417	0.022	0.765	0.308	0.244
Step-down p-val	0.001	0.001	0.071	0.009	0.692	0.081	0.748	0.692	0.603
Comparison mean	0.143	0.118	0.496	0.067	0.662	1961.960	0.286	0.126	0.253
N	836	836	833	833	831	831	833	821	402
Panel C: Male									
Treatment	0.011	0.023	-0.048	0.012	0.052**	128.669	0.108***	-0.010	-0.008
	(0.030)	(0.027)	(0.031)	(0.023)	(0.026)	(311.900)	(0.036)	(0.025)	(0.042)
P-value	0.711	0.389	0.126	0.615	0.046	0.680	0.003	0.676	0.843
Step-down p-val	0.992	0.903	0.424	0.992	0.379	0.992	0.017	0.992	0.992
Comparison mean	0.208	0.153	0.284	0.108	0.827	4364.069	0.405	0.137	0.314
N	826	826	824	822	806	806	824	811	488
P-val male=fem	0.005	0.038	0.420	0.077	0.617	0.296	0.017	0.672	0.561

Notes: Includes the main outcomes in 2023 from Table 3, Table 4, and Table A6. All regressions use entropy balancing to adjust the weights of observations. Following Hainmueller (2012), this method corrects the imbalances in the sample caused by differential attrition in 2023. The characteristics used for balancing are 'age in 2008', 'BECE exam performance', 'no male head in the household', 'highest education of household head: SHS or more', 'highest education of household head: primary or less', and 'perceived returns to SHS'.

Table B5: Comparing Compliers and Always-Takers

	(1) 2007 BECE cohort	(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	0.000**	-0.002	-0.068	-0.247	25.098	13.554	-0.067
	(0.000)	(0.005)	(0.149)	(0.333)	(39.441)	(28.993)	(0.043)
P-value	0.033	0.743	0.647	0.459	0.525	0.640	0.115
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	-0.000	-0.005	-0.006	-0.440	38.000	9.553	-0.066
	(0.000)	(0.007)	(0.208)	(0.496)	(57.588)	(35.854)	(0.063)
P-value	0.102	0.443	0.976	0.376	0.510	0.790	0.290
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	.	0.509	0.802	0.483	0.852	0.966	0.992

Notes: See Table 1 notes. For column (1), among females, 746 had taken the junior high school finishing exam (BECE) in 2008 and 290 had taken it in 2007. None had enrolled in SHS by October 2008. 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 B6: Cognitive Skills: Additional Outcomes

	(1) Memory for digit span (forward) (2013)	(2) Memory for digit span (backward) (2013)	(3) Raven's progressive matrices (2013)
Panel A: All			
Treatment	0.003	0.104	-0.013
	(0.120)	(0.086)	(0.118)
P-value	0.979	0.226	0.914
Step-down p-val	0.993	0.500	0.993
Comparison mean	7.544	4.541	6.954
N	1983	1983	1981
Panel B: Female			
Treatment	-0.026	0.045	-0.041
	(0.170)	(0.119)	(0.168)
P-value	0.880	0.702	0.809
Step-down p-val	0.958	0.958	0.958
Comparison mean	7.381	4.374	6.558
N	1002	1002	1001
Panel C: Male			
Treatment	0.037	0.158	0.019
	(0.170)	(0.125)	(0.165)
P-value	0.826	0.207	0.907
Step-down p-val	0.983	0.457	0.983
Comparison mean	7.714	4.714	7.368
N	981	981	980
P-val male=fem	0.800	0.519	0.940

Notes: See Table 1 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 B7: Non-renumerated labor (2022)

	(1)	(2)	(3)	(4)	(5)	(6)
	Family farm		Family enterprise		Family household	
	Any help	Monthly hours	Any help	Monthly hours	Any help	Monthly hours
Panel A: All						
Treatment	0.005	1.395	0.002	1.573	-0.010	1.178
	(0.017)	(1.224)	(0.011)	(1.624)	(0.019)	(2.864)
P-value	0.784	0.255	0.869	0.333	0.613	0.681
Step-down p-val	0.984	0.818	0.984	0.833	0.984	0.984
Comparison mean	0.130	5.336	0.045	3.608	0.826	41.523
N	1751	1751	1751	1751	1751	1751
Panel B: Female						
Treatment	0.030	1.809	0.020	5.240*	-0.017	2.641
	(0.023)	(1.519)	(0.016)	(2.976)	(0.020)	(5.275)
P-value	0.203	0.234	0.219	0.079	0.381	0.617
Step-down p-val	0.651	0.651	0.651	0.212	0.651	0.651
Comparison mean	0.104	3.884	0.043	3.951	0.928	62.417
N	882	882	882	882	882	882
Panel C: Male						
Treatment	-0.020	1.010	-0.017	-2.059*	-0.001	-0.186
	(0.025)	(1.938)	(0.013)	(1.206)	(0.032)	(2.328)
P-value	0.422	0.603	0.208	0.088	0.966	0.936
Step-down p-val	0.872	0.931	0.712	0.664	0.998	0.998
Comparison mean	0.157	6.836	0.048	3.254	0.720	19.930
N	869	869	869	869	869	869
P-val male=fem	0.135	0.718	0.087	0.023	0.735	0.577

Notes: See Table 1 notes. Data from 2022 phone survey. Respondents were asked: "In the last 4 weeks, how much time did you spend to help your family in the following activities? (unpaid help)".

Table B8: Earnings summary statistics

	Summary Statistics (2019)				Summary Statistics (2023)			
Variable	Median	Mean	SD	Obs.	Median	Mean	SD	Obs.
Panel A: Female								
Total earnings (GHX) in the last 6 months in:								
Public Service	2,224	2,911	2,413	86	5,298	5,834	4,225	104
High-skill Service (Private)	1,550	2,225	1,870	22	2,600	2,834	2,320	37
Low-skill Service (Private)	1,015	1,441	1,376	176	1,850	2,638	3,196	157
Agriculture (Self-employed)	810	718	332	11	1,782	1,791	118	26
Trade	815	1,391	1,880	200	1,200	1,851	2,352	271
Industry	800	1,275	1,227	19	1,300	2,035	2,022	18
Panel B: Male								
Total earnings (GHX) in the last 6 months in:								
Public Service	2,773	3,191	2,310	94	9,000	8,184	4,995	93
Industry	2,400	2,931	2,458	89	3,700	4,996	4,555	80
High-skill Service (Private)	2,400	2,756	2,326	64	5,350	6,699	5,463	65
Transport	2,100	2,469	1,990	93	3,400	4,410	3,551	101
Low-skill Service (Private)	2,000	2,362	2,036	109	3,600	4,383	3,803	102
Agriculture (Self-employed)	1,470	1,253	375	52	2,156	2,115	179	49
Trade	1,800	2,460	2,145	74	3,100	4,049	3,521	77
Construction	1,750	2,106	1,613	102	3,100	4,424	4,150	98
Agriculture (Wage-employed)	1,300	1,808	1,575	29	3,000	3,177	2,252	29

Notes: High education service in the private sector includes bankers, engineers, accountants, journalists, and pharmacists, among other professions. Public service includes nursing, government work, (pupil) teaching, police and the military. Inflation rates are 9.9% (2020), 10.0% (2021), 31.3% (2022), and 38.2% (2023).

Table B9: Labor Market Outcomes during COVID Crisis

	(1) Any earnings in past 6 months (2020)	(2) Has wage contract with employer (2020)	(3) Total earnings in past 6 months (2020)	(4) Total earnings April (2020)	(5) Coeff. of variation of monthly earnings (if > 0) (GHX) (2020)	(6) Self-employed (2020)
Panel A: All						
Treatment	0.046**	0.047***	36.821	24.652	-1.010	-0.066***
	(0.022)	(0.016)	(119.921)	(20.032)	(3.898)	(0.023)
P-value	0.036	0.003	0.759	0.219	0.796	0.004
Step-down p-val	0.138	0.014	0.877	0.406	0.877	0.044
Comparison mean	0.712	0.081	1767.466	225.448	76.596	0.342
N	1685	1742	1685	1711	1258	1745
Panel B: Female						
Treatment	0.075**	0.067***	253.820*	62.323***	-10.117	-0.070**
	(0.035)	(0.021)	(149.647)	(23.773)	(6.156)	(0.034)
P-value	0.033	0.001	0.090	0.009	0.101	0.040
Step-down p-val	0.168	0.003	0.183	0.034	0.183	0.168
Comparison mean	0.588	0.049	1013.643	113.239	89.384	0.386
N	836	862	836	851	518	862
Panel C: Male						
Treatment	0.017	0.027	-173.632	-12.156	5.515	-0.062**
	(0.026)	(0.024)	(186.064)	(32.055)	(5.038)	(0.031)
P-value	0.515	0.263	0.351	0.705	0.274	0.046
Step-down p-val	0.796	0.691	0.691	0.796	0.691	0.361
Comparison mean	0.837	0.113	2526.751	338.861	67.696	0.298
N	849	880	849	860	740	883
P-val male=fem	0.191	0.218	0.085	0.069	0.046	0.792

Notes: See Table 1 notes. The 2020 survey was administered over the phone (no in-person tracking) between May 19 and September 25 2020. We control for survey week, since the survey was spread over three months and the COVID-19 situation was evolving rapidly, with restrictions easing over time.

Table B10: 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	0.022	-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	0.204	0.268	0.422	0.458	0.850	0.850	0.626	0.406
Step-down p-val	0.747	0.829	0.893	0.893	0.963	0.963	0.919	0.893
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*	-0.049	0.007	0.000	-0.022	-0.012
	(0.027)	(0.029)	(0.035)	(0.035)	(0.010)	(0.010)	(0.023)	(0.025)
P-value	0.445	0.774	0.077	0.162	0.492	1.000	0.319	0.636
Step-down p-val	0.913	0.956	0.420	0.641	0.913	0.999	0.846	0.951
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	0.073	0.282	0.921	0.963	0.963	0.963	0.401	0.401
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	0.128	0.086	0.194	0.416	0.877	0.074	0.136

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.