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ABSTRACT

Unintended Consequences of Youth Entrepreneurship Programs: Experimental Evidence from Rwanda*

The persistently high employment share of the informal sector makes entrepreneurship a necessity for youth in many developing countries. We exploit exogenous variation in the implementation of Rwanda's entrepreneurship education reform in secondary schools to evaluate its effect on student economic outcomes up to three years after graduation. Using a randomized controlled trial, we evaluated a three-year intensive training for entrepreneurship teachers, finding pedagogical changes as intended and increased entrepreneurial activity among students. In this paper, we tracked students following graduation and found that increased entrepreneurship persisted one year later, in 2019. Students from treated schools were six percentage points more likely to be entrepreneurs, an increase of 19 percent over the control mean. However, gains in entrepreneurship faded after three years, in 2021. Employment was six percentage points lower in the treatment group. By some measures, income and profits were lower in the treatment group, with no robust differences in these outcomes overall. Lower incomes and profits were concentrated among marginal students induced into entrepreneurship by the program. Youth entrepreneurship programs may therefore steer some participants away from their comparative advantage. Nonetheless, the program increased university enrollment, suggesting the potential for higher long run returns.

JEL Classification:
I25, I26, I28, J24, O12, O15

Keywords:
entrepreneurship education, youth employment, secondary school, pedagogy, randomized controlled trials, Rwanda

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1 Introduction

Entrepreneurship has been considered central to innovation and economic growth since at least Schumpeter ([1942] 1976). In developing countries, entrepreneurship must play a dual role, promoting growth and absorbing the persistently high share of self- and informal sector employment (World Bank 2018b). In Sub-Saharan Africa, the world's youngest region by demographics, youth exit school into an economy with "missing jobs," making entrepreneurship a necessity (Sumberg et al. 2021). In Rwanda, 72 percent of employed youth are self-employed or in family firms, a characteristic of low productivity informal sector activity in the region (Filmer and Fox 2014; African Economic Outlook 2016; Fox, Senbet, and Simbanegavi 2016; Bandiera et al. 2022). Increasing skills among the self-employed is therefore a policy priority in Sub-Saharan Africa. One potential solution is to align school curricula with the skills necessary for better school-to-work transitions (Blimpo and Owusu 2019).

Rwanda has integrated entrepreneurship education into formal schooling more than perhaps any other country worldwide. Entrepreneurship has been a required secondary school subject since 2009. In 2016, Rwanda reformed its primary and secondary school curricula, including the required secondary entrepreneurship course, by introducing interactive pedagogy more focused on practical skills. However, the reform was challenging for teachers because "implementing student-centered instruction effectively requires skills well beyond those of a great many teachers in developing countries" (Murnane and Ganimian 2014, p. 42).

We evaluate, through a randomized controlled trial (RCT), a teacher training program intended to solve this implementation challenge. From a sample of more than 200 secondary schools, we randomly assigned half to receive a comprehensive program consisting of intensive training, peer feedback groups, and follow-up support lasting more than two years. Our endline evaluation, conducted as students completed secondary school, found high takeup among teachers, pedagogical changes as intended by the curriculum reform, and increased entrepreneurial activity among students (Blimpo and Pugatch 2021). This paper reports results from follow-up surveys with students in 2019 and 2021, one to three years after secondary school.

We find increased entrepreneurship in response to the program in the one-year follow-up in 2019, continuing a trend from the endline. Students in treated schools were six percentage points more likely to be involved in business, an increase of 19 percent over the control mean. Businesses were more likely to originate from student business clubs, an emphasis of the intervention. We find suggestive evidence of declines in secondary exit exam scores in response to treatment, consistent with misalignment between the interactive pedagogy of the new curriculum and the persistence of traditional assessment methods.

Gains in economic activity faded in the three-year follow-up in 2021, however. Treated students were no longer more likely to be entrepreneurs, though they remained more involved in

businesses originated by student clubs. Employment was six percentage points lower in the treatment group. However, treated students were four percentage points more likely to be enrolled in university, relative to a control mean of 14 percent. By some measures, income and profits were lower in the treatment group, with no robust differences in these outcomes overall. Exploratory analysis using variation in local COVID-19 prevalence fails to reveal evidence of the pandemic as a key mechanism explaining these results. Instead, lower incomes and profits appear concentrated among marginal students induced into entrepreneurship by the program.

Results fell short of expectations in several ways. The fade-out of gains in entrepreneurship within three years and the lack of income gains measured at any survey wave are disappointing to policymakers who hoped the program would spur greater and more productive economic activity. Even the short-term gains in entrepreneurship observed after one year fell short of expert expectations (DellaVigna, Otis, and Vivalt 2020). Nonetheless, the program was implemented relatively well, with significant involvement from an international NGO with high capacity. It led to demonstrable pedagogical change compared to a traditional approach focused on knowledge accumulation. Yet these changes in teacher practice did not translate into robust gains in measured skills, nor ultimately into improved economic welfare. The lack of durable changes in the intended student outcomes underscores the difficulties in escaping the "tyranny of the curriculum" in developing country education systems (Duflo 2022).

Our results sound a note of caution about youth entrepreneurship programs. Conceptually, these programs operate along two margins: 1) increasing incomes by building skills, and 2) reducing entry costs by providing information and business exposure. If a sufficient gain in skills does not accompany the reduction in entry costs, the marginal students induced into entrepreneurship might earn lower incomes than in the absence of the program. We embed this idea in a simple sectoral choice model and find evidence consistent with its predictions. Our study complements the microcredit expansion RCT of Banerjee et al. (2019), in which novice "reluctant entrepreneurs" gain less than "gung-ho entrepreneurs" with prior business experience. Our results add a new twist: young, reluctant entrepreneurs may even be harmed by programs designed for their benefit, at least in the medium-term, adverse economic conditions of our study.

Despite these results for economic activity, increased university enrollment among the treatment group provides grounds for optimism. Although the program did not focus on university enrollment, its emphasis on building skills and autonomy may have motivated participants to continue their studies. We find university enrollment increased most among academically high-performing students and for business programs. If this university training yields reasonable returns, the treatment may prove cost-effective in the long run.

We make three main contributions to the literature. First, we add evidence from secondary schools to the literature on teacher training in developing countries. Much in-service teacher training fails to improve student outcomes despite substantial government investments (e.g., Loyalka et al. 2019). But, programs focusing on a single subject, incorporating lesson enactment,

and follow-up visits are associated with positive student outcomes (World Bank 2018a; Popova et al. 2022). The program we study included these elements. While most evidence on teacher training in developing countries stems from primary schools (Null et al. 2017), we contribute to the thin evidence on secondary schools, a setting where teacher knowledge and subject-specific skill may be critical.

Second, we contribute to the literature on improving teaching quality through pedagogical change, a key mechanism underlying successful education interventions in developing countries (Evans and Popova 2016). Rwanda's curriculum reform envisioned a pedagogical shift from traditional knowledge acquisition to student-centered, active learning. Other efforts to promote active learning have shown promise in primary grades (Bruns, Costa, and Cunha 2018; Marinelli, Berlinski, and Busso 2021). The program we study included NGO support for design and implementation, had high takeup among teachers, and led to many of the intended pedagogical changes. Therefore, it is an apt proof of concept test for expansions of similar programs. Nonetheless, most of the intended benefits for students failed to materialize or persist. Our results sound a similar cautionary note as an experiment promoting active learning in secondary school mathematics in Costa Rica. In that study, control group students learned more than the treatment group, despite 40 hours of training for treated teachers (Berlinski and Busso 2017). The circumstances under which pedagogical changes improve student outcomes therefore remain an area open for inquiry, with secondary schools posing a particular challenge.

Third, we contribute to the literature on entrepreneurship education and business training.[1] A meta-analysis of the recent literature found business training increases sales and profits by an average of five to ten percent (McKenzie 2021). While most programs focus on adult entrepreneurs, entrepreneurship is often part of broader efforts to increase youth skills and employability (for reviews, see Blattman and Ralston 2015 and Fox and Kaul 2018). Within this literature, several experiments have found increased entrepreneurship from programs promoting youth economic activity (Blattman, Fiala, and Martinez 2014; Blattman, Dercon, and Franklin 2019; Blattman, Fiala, and Martinez 2020; Blattman and Dercon 2018; Bertrand et al. 2021). However, most of these programs provided start-up grants or bundled entrepreneurship training with credit or other services.

Only a few experiments evaluate youth entrepreneurship training independent of broader support. For example, university students randomly assigned to study entrepreneurship in Tunisia were more likely to pursue self-employment, but the effects faded four years later (Premand et al. 2016; Alaref, Brodmann, and Premand 2020), similar to results from our study.

Two other RCTs evaluate entrepreneurship education in settings similar to ours. A six-week, gamified online program for Rwandan secondary school students complementing the required entrepreneurship course more than doubled business activity, employment, and earnings (Lafortune et al. 2022). Although these results were short-term, the program was evaluated in

[1] We also contribute to evidence on business training for soft skills (Campos et al. 2017; Alibhai et al. 2019; Chioda et al. 2021; Ubfal et al. 2022; Lafortune et al. 2022).

early 2021, a challenging period of the pandemic, with effect magnitudes far exceeding the short-term results we found at the endline in 2018 (Blimpo and Pugatch 2021). In Uganda, an intensive three-week program for recent secondary school graduates led to increased business creation, survival, and earnings over three years later (Chioda et al. 2021). The program was designed, in part, by the same NGO as our study and implemented among students with a similar profile.

We offer two leading explanations for the divergent results between these studies and ours. First, these other programs were short and intensive, rather than being embedded in a traditional academic setting as in this study. Second, although all programs were evaluated using RCTs, the other programs randomly assigned offers among interested participants, a population self-selected for high interest and motivation in learning entrepreneurial skills. By contrast, students in our program represent all Rwandan secondary school students, for whom entrepreneurship education is compulsory. The differing results likely reflect heterogeneity among these distinct study populations.

More broadly, efforts to improve youth economic outcomes often focus on labor supply, seeking to address deficiencies in youth economic skills, particularly in regions with rapidly growing young populations such as Sub-Saharan Africa (e.g., Leopold et al. 2017). Rwanda's entrepreneurship education requirement and the accompanying teacher training program we study exemplifies this approach. Other approaches focus instead on deficiencies in labor demand, reframing poor youth economic outcomes not as a byproduct of demographics but the result of "missing jobs" or poverty traps (Sumberg et al. 2021; Bandiera et al. 2022). In this view, successful youth employment programs are rare due to low underlying demand; even nominally effective programs can mask displacement of others competing in the same market. The policy implication is to promote structural transformation rather than focus on youth skills. Our study provides a new data point in this debate, suggesting some youth may be harmed by entrepreneurship promotion efforts, by diverting them from economic activities in which they would otherwise have comparative advantage. Our results suggest caution when considering scaling entrepreneurship programs to youth populations without previously demonstrated interest in running their own businesses. Nonetheless, exposure to entrepreneurship training may yield ancillary benefits for these youth by encouraging them to pursue further human capital investments.

2 Program description and data

2.1 Entrepreneurship education in Rwandan secondary schools

Secondary school in Rwanda consists of six grades, split between lower (S1-S3, or grades 7-9) and upper secondary (S4-S6, or grades 10-12). At the start of the intervention in 2016, gross enrollment in Rwandan secondary schools was 39 percent for girls and 36 percent for boys (World Bank 2020). Several entities administer secondary schools, including 30 percent public, 40 percent Catholic, and the remainder by other religious or private institutions (Rwanda Ministry of

Education 2016, p. 38). Entrepreneurship education is compulsory in all secondary grades. This requirement, in place since 2009, makes Rwanda the "site of one of the most extensive efforts to promote youth entrepreneurship in the world" (Honeyman 2016, p. xii).

Most Rwandan youth transition from school to work during the secondary school years. In the most recent census (2012), 63 percent of youth between ages 15-19 were enrolled in school. Among youth aged 20-24, the enrollment rate fell to 24 percent, with 4 percent attending university. During the same ages, employment rose from 25 percent at ages 15-19 to 54 percent at ages 20-24, indicating that many youth transition from secondary school to the labor market. Most employed youth are self-employed or work for a family firm (74 percent) and in agriculture (67 percent). The scarcity of wage labor has led policymakers to focus on entrepreneurial skills for youth.

The launch of the intervention in 2016 coincided with an ambitious curricular reform which included the required secondary school entrepreneurship course. Whereas the previous course focused heavily on the legal and regulatory environment (Honeyman 2016), the reformed course covered the entire cycle of business creation and development, including product development, marketing, accounting, and customer relations. In addition to business skills, the course also covered soft skills, such as communication and setting goals.

The pedagogy of the new entrepreneurship course emphasized active learning and student engagement, a significant departure from the previous approach. A centerpiece of the new approach was "Skills Labs," a weekly 80-minute class (double the normal length) in which students practiced business skills through role-play and group projects. The new course also encouraged students to form "student business clubs," school-based businesses intended to generate revenue.

Overall, the new entrepreneurship course required teachers to adopt content and pedagogy which differed dramatically from the previous approach. Nonetheless, students were still assessed by national exams, which continued to focus on accumulating factual knowledge. This dichotomy created tension for teachers faced with pressure to implement the new curriculum while preparing students for the traditional exams.

2.2 Program and research design

All Rwandan secondary schools received the new entrepreneurship curriculum described above. Our study evaluates a teacher training intervention, delivered to a subset of upper secondary entrepreneurship teachers, focused on effective implementation of the new curriculum. The training was designed and supervised by Educate!, an international NGO that collaborated with the Rwandan government on the revised entrepreneurship course. The training, called Educate Exchange, ran from 2016 to 2018 and consisted of:

1. *In-service teacher training*: 24 days, spread across six sessions of four days each. The training emphasized lesson planning and engaging students in discussions, creating

entrepreneurship "portfolios," and student business clubs. Each four-day session culminated in a day focused on lesson practice. Trainings were delivered in a "cascade" model, led by government trainers previously trained by Educate! staff.

2. *Exchange visits*: class observations and feedback sessions among participating entrepreneurship teachers, district education officials, and Educate! staff (three sessions per year).
3. *Outreach and support*: schools received regular visits from Educate! staff to support curricular implementation (six visits per year). Visits included product-making demonstrations (e.g., for household goods such as soap or candles) for students co-taught with the teacher, student business club advising, classroom observation, and teacher feedback. Additionally, student business clubs were encouraged to submit their ideas to regular interscholastic business competitions held for treated schools.

The intervention focused on the cohort entering upper secondary school (S4, or 10th grade) in 2016, with training provided to this cohort's entrepreneurship teacher(s). Control group teachers received only the standard government in-service training, not specific to entrepreneurship.[2]

The intervention, therefore, included several elements found effective in teacher training programs in developing countries, including in-person training, lesson enactment, and focus on a specific subject (Popova et al. 2022). The exchange and outreach components also build on studies of teacher coaching and support, many of which have proven successful (e.g., Beuermann et al. 2013; Abeberese, Kumler, and Linden 2014; Piper and Zuilkowski 2015, Bruns, Costa, and Cunha 2018; Albornoz et al. 2018; Cilliers et al. 2019). On the other hand, the program also relied on a cascade training model, which has not proven as successful but was considered important to facilitate any future scale-up.

Because all secondary schools were required to deliver the new entrepreneurship curriculum, we cannot measure its effects relative to the old curriculum. Nonetheless, training teachers to implement an ambitious new curriculum can effectively generate exogenous variation in student exposure to the curriculum as intended. Moreover, control group receipt of the default government teacher training also makes the results highly relevant for policy.

The research design is a cluster randomized controlled trial (RCT), with schools as the unit of treatment. We stratified treatment by district and a dummy for public school, leaving 22 strata. The sample includes 207 schools, randomly assigned to treatment (103) and control (104).

[2] Government training was scheduled for ten days in 2016, with refresher sessions to be held in subsequent years. Each district could set the details of these sessions. We do not have data on implementation but suspect that training quantity and quality varied across districts, based on uneven responses to queries with district officials. Even if implemented as intended, training in control schools differed from treatment by occurring for fewer days, without NGO training and input, and without a standardized training curriculum.

2.3 Data

We have four rounds of data on students from schools participating in the study: baseline (2016), endline (2018), and follow-up rounds in 2019 and 2021. The 2016 baseline survey sampled 15 students per school from the study cohort before the intervention began, for 3,095 students total.[3] Each subsequent round followed these same students. The 2018 endline surveyed students midway through their final year of secondary school. The 2019 survey occurred in June and July of the year after secondary school graduation. The 2021 survey occurred in July and August, nearly three years after secondary school graduation and in the midst of the COVID-19 pandemic.[4] Baseline and endline surveys were conducted at schools, while the 2019 and 2021 follow-ups were conducted by phone.[5] Surveys focused on academic outcomes, business and soft skills, household formation, and economic activity.

We reported endline results in earlier work (Blimpo and Pugatch 2021). This study reports results from the follow-up surveys in 2019 and 2021, bracketing the onset of the COVID-19 pandemic in 2020.

The COVID-19 pandemic was a large economic shock for Rwanda. In June 2020, more than 80 percent of Rwandan households reported a drop in income relative to February. More than half reported reducing or skipping meals (Egger et al. 2021). Economic recovery remained modest by November 2020, with 71 percent of households continuing to report lower income than before the pandemic (Warren, Parkerson, and Collins 2021). Our 2021 survey coincided with a spike in COVID-19 cases in Rwanda, rising from 3 per million population at the beginning of June to a peak of over 100 per million in late July, when our survey was in the field (Ritchie et al. 2020).[6]

In our data, attrition was relatively low in the 2018 endline and 2019 follow-up, with 93 percent and 84 percent of baseline respondents completing each survey, respectively. However, attrition rose sharply in the 2021 follow-up, with 50 percent survey completion. We attribute this high attrition to the dual challenges of tracking a highly mobile population and the pandemic. An evaluation of a different secondary school entrepreneurship education program in Rwanda also experienced a 50 percent attrition rate in 2021 (Lafortune et al. 2022). Nonetheless, we find no evidence of differential attrition by treatment status across all survey rounds. Table 1 reports the results of regressions of attrition on treatment status in the 2019 and 2021 data. The table also reports results of specifications interacting treatment with baseline characteristics, following our

[3] The average number of sampled students per school is less than 15 due to a small number of schools with smaller cohorts. In those schools, all students in the entering cohort were sampled.
[4] Time relative to secondary school completion refers to normal academic progress of one grade level per year. All surveys included students from the baseline regardless of academic progress.
[5] A subsample of respondents to the 2019 survey were also surveyed in person. The in-person survey asked additional questions not asked in the phone survey. Selection for the in-person survey was based on completion of the initial phone survey, respondent availability and proximity to interview locations in the capital Kigali, considerations for gender balance, and survey budget constraints. We use data from the in-person 2019 survey only if the question was not asked in the phone survey. All other 2019 data are from the phone survey.
[6] For context, these rates were similar to the United States at that time, before the Delta wave arrived.

analysis plan (main effects and strata dummies are also included).[7] We fail to reject the joint null of zero on all treatment coefficients across all specifications.

Table 2 reports balance on baseline characteristics separately for the 2019 and 2021 samples, using the same baseline characteristics from all analysis plans. We find imbalances at conventional significance levels between the treatment and control groups on several baseline characteristics in the two surveys, more than would be expected by chance. Collectively, the relatively high rates of attrition and imbalances in baseline characteristics in the remaining samples led to adjustments in our empirical approach relative to our analysis plan. We detail these adjustments in the next section.

3 Methodology

The research design is a cluster RCT, with treatment assignment at the school level. Our primary analysis uses the ordinary least squares (OLS) regression:

$$y_{isg} = \alpha + \beta T_{sg} + X_{0isg}\delta + \gamma_g + \varepsilon_{isg} \qquad (1)$$

where i indexes students; s indexes schools; and g indexes strata. The strata are district-school type cells, where school types are public and non-public. In equation (1), y is an outcome; T is an indicator for treatment assignment; X_0 is a vector of pre-intervention characteristics; γ is a stratum fixed effect; and ε is an error term. Because randomization occurred within strata, the strata fixed effects ensure that treatment assignment T is unrelated to the error term. The coefficient of interest is β, which measures the intent to treat (ITT), or the effect of the offer of teacher training T on the mean outcome. We cluster standard errors by school.

The specification in equation (1) and the choice of outcomes follow analysis plans for each survey round submitted to the AEA RCT Registry before analyzing the corresponding round of data. These analysis plans were informed by the endline evaluation, which was published as a Registered Report, i.e., it underwent pre-results peer review (Blimpo and Pugatch 2019; 2021).

The analysis plan specified that the vector X_0 include the baseline outcome (where available) and, at minimum, the baseline characteristics found to be imbalanced in the endline analysis. Appendices A-B report the populated analysis plan (Banerjee et al. 2020).[8] However, our tests for baseline balance using the 2019 and 2021 samples revealed additional imbalances not present at the endline (Tables 2, B.10-B.12). In addition, high attrition in the 2021 survey is also a cause for concern, suggesting additional controls should be added to equation (1).

[7] The specifications for differential attrition appeared in the 2021 analysis plan, with baseline characteristics carried over from the endline and 2019 analysis plans.

[8] To be precise, the 2021 analysis plan specified inclusion of the baseline outcome and the covariates previously found to be imbalanced (female, an employment dummy, and grit), at minimum. The 2019 analysis plan specified inclusion of the baseline outcome only. The populated analysis plan (Appendices A-B) report results from these specifications as written. In our view, the approach we describe in this section is consistent with the analysis plan though its details were not specified in advance.

Rather than arbitrarily choose which variables to include in X_0, we rely on the post-double selection (PDS) lasso (Belloni, Chernozhukov, and Hansen 2014). The PDS lasso is a principled approach to covariate selection that can consider many potential covariates but prevents overfitting by penalizing the inclusion of covariates with minimal predictive value. The PDS lasso proceeds in three steps (Ahrens, Hansen, and Schaffer 2018; 2019):

1. *Outcome prediction*. Fit lasso regression to the outcome, omitting the treatment variable:

$$y_{isg} = \tilde{X}_{0isg}\theta + \varepsilon_{isg} \qquad (2)$$

   where $\tilde{X}_0$ is a vector of candidate baseline covariates. Denote the set of covariates with non-zero coefficients from equation (2) as A.
2. *Treatment prediction*. Fit lasso regression to the treatment:

$$T_{isg} = \tilde{X}_{0isg}\theta + \varepsilon_{isg} \qquad (3)$$

   Denote the set of covariates with non-zero coefficients from equation (3) as B.
3. *Treatment effect estimation*. Run the OLS regression in equation (1), setting $X_0 = A \cup B$, the union of baseline covariates with non-zero coefficients from Steps 1-2.

We include the baseline outcome and strata dummies without penalty. All other covariates are chosen from a covariate pool, including all baseline characteristics and outcomes specified in the analysis plan, quadratics in the continuous variables, and all two-way interactions.[9] This results in a candidate pool of 835 covariates. We estimate equation (1) separately for 2019 and 2021.[10]

While the PDS lasso can account for biases arising from selection on observed characteristics, bias due to selection on unobserved characteristics may persist. To address this concern, we check robustness of our results to the sample selection correction of Behaghel et al. (2015). This method

[9] The baseline variables are: female, asset index, dummy for mother completing at least primary school, dummy for repeating grade 10, grade 9 exam score (z), dummy for employment during last school break, dummies for question on calculating profit, dummy for question on calculating compound interest, dummy for aspiration to attend post-secondary schooling, dummy for aspiration to start business, grit (z), locus of control (z), dummy for discount rate less than 100 percent, dummy for entrepreneurship, dummy for entrepreneurship with schoolmates, dummy for non-agricultural business, dummy for employment, earnings in last two months, business income in last two months, dummy for any savings, dummies for intervals of savings level, and dummy for borrowing for business purpose.

[10] Because many of our outcomes are measured in each survey, an alternative approach would be to pool the data (potentially adding the 2018 endline) and use the ANCOVA specification recommended by McKenzie (2012). Although this approach would increase power, particularly for potentially noisy outcomes such as profits, we prefer to examine outcomes separately for each round of data. In our view, each round of data measures outcomes at these different stages of respondents' post-secondary transitions, rather than representing measures of a stable process. Moreover, the 2019 and 2021 data represent distinct economic and social environments bracketing the 2020 onset of the pandemic.

balances the analysis sample on the phone call attempts to each potential respondent, a proxy for the unobserved reluctance to respond to the survey. Due to data limitations, we can only apply the method to the 2021 data, but this round is also cause for the most concern due to its high attrition. We explain the procedure in more detail in Section 4.2.1.

4 Results

4.1 Main results

Although we focus on the 2019 and 2021 surveys, for context we briefly summarize the endline (2018) results (Blimpo and Pugatch 2021). Among teachers, program takeup was high (88 percent training attendance), leading to pedagogical changes aligned with the revised entrepreneurship curriculum. However, among students we found no changes in secondary school persistence, entrepreneurship exam scores, non-cognitive skills, or aspirations in response to the program. Students in treated schools became more entrepreneurial, increasing entrepreneurship by 5 percentage points relative to a control mean of 30 percent.[11] Employment decreased by an equivalent 5 percentage points, leaving overall economic activity and income unchanged. To place these results in context, 85 experts were surveyed on expected endline results (DellaVigna, Otis, and Vivalt 2020). Among these experts, mean predictions were -2 percentage points for secondary school enrollment (i.e., an increase in dropout), +0.29 standard deviations for entrepreneurship exam scores, and +12 percentage points for entrepreneurship. Although the enrollment results fell within the expected range, the upper bounds of the 95 percent confidence intervals for entrepreneurship exam scores and entrepreneurship fell short of expert predictions.

In the 2019 and 2021 surveys, respondents were asked to report their academic and economic activities in recent months in each round. The 2019 survey asked about each month from January-June of that year. The 2021 survey asked about February, May, and November 2020, and February and July/August 2021. These dates were chosen to represent salient periods bracketing the COVID-19 pandemic, without overwhelming respondents by asking about all months. Respondents could choose all applicable activities for each calendar month. Although this method is subject to recall bias, we think it provides a useful portrait of post-secondary transitions in our sample.

Figure 1 presents the treatment and control means over time, with a conventional 95 percent confidence interval on the treatment mean for illustration. Table 3 presents formal results, with each cell reporting the treatment coefficient from equation (1) for the indicated activity and month. We find no significant differences between treatment and control groups for secondary

[11] We measure entrepreneurship as an affirmative response to a survey question about "business participation." Across all survey waves, we distinguished between business participation and paid employment when asking respondents about economic activity. Therefore, business participation likely captures economic activity which depends directly on the enterprise's profits, consistent with our notion of entrepreneurship.

school and TVET (technical and vocational education and training) across all months. University participation is significantly higher for treated respondents beginning in 2020, with a magnitude of 4.1 percentage points relative to an initial control mean of 10 percent in February 2020. The magnitude remains about 4 percentage points throughout, with notable persistence even as university participation in the control group falls in the latter part of 2020.

Entrepreneurship is about 6 percentage points higher among the treatment group throughout 2019. However, this activity is partially offset by lower employment during that time. In 2020 the gap in business activity disappeared, while the gap in employment grew and persisted, with treatment group employment 4-6 percentage points below the control group in 2020-2021. The results suggest that the program's initial gains in entrepreneurship were difficult to sustain during the pandemic. Meanwhile, greater reliance on wage employment among the control group may have provided more economic resiliency during a volatile time.

The remaining results refer to responses at the time of each survey. Table 4 presents results for various measures of skills. Column (1) refers to the aggregate score on the high school exit exam, standardized to the control group and based on self-reports because we could not obtain administrative data.[12] We find a decline of .09 standard deviations in response to treatment, significant at 10 percent. The result is consistent with crowding out of exam preparation due to increased focus on entrepreneurship in treated schools. It is also consistent with the lack of alignment between the practical skills emphasized in the reformed curriculum and the persistence of traditional exam-based assessment, particularly in treated schools (Spivack 2021).[13,14]

We examine three non-cognitive skills indices: 1) grit (Duckworth et al. 2007; Duckworth and Quinn 2009); 2) belief in the future, a subscale measuring optimistic attitudes from the Chinese Positive Youth Development Scale (Shek, Siu, and Lee 2007); and 3) entrepreneurial spirit, from the business consulting RCT evaluated in Bruhn, Karlan, and Schoar (2018). We standardize each index to the control group. Other skill outcomes include whether the respondent's monthly

[12] This outcome is distinct from the exam score reported in Blimpo and Pugatch (2021), which was for the entrepreneurship subject test only. Entrepreneurship exam scores were statistically indistinguishable between treatment and control students.

[13] Muralidharan, Singh, and Ganimian (2019) report a similar finding for students at the bottom of the ability distribution in response to a "teaching at the right level" intervention in primary schools in India. An instructive counterexample comes from Tanzanian primary schools, where a curriculum reform emphasized foundational literacy and numeracy. Cohorts exposed to the new curriculum experienced increased instructional time and learning gains in the targeted subjects. Students whose teachers received training in the new curriculum saw larger test score gains (Rodriguez-Segura and Mbiti 2022).

[14] Table C.1 presents additional academic outcomes from the analysis plan. Using the contemporaneous survey measure, university enrollment is significantly larger among treated students in 2019 but not in 2021. This is the opposite pattern found in the calendar recall data (Table 3, Panel B). The question wording was consistent across survey rounds. The calendar data asked if the respondent was "engaged in" the activity in the indicated month, while the survey asked if the respondent was "currently enrolled." One potential explanation for divergent responses between these questions would be if some students were enrolled for future study but not yet actively attending in 2019. Another possibility is that students gained access to remote learning opportunities at universities in 2021, thereby "engaged in" university study without officially enrolling. The data are internally consistent, with both university measures highly autocorrelated within individuals (Table C.2). Although we lack a clear resolution to the puzzle, the data show an increase in university enrollment in the treatment group compared to the control, though the timing is unclear.

discount rate is less than 100 percent, measured as a dummy for preferring 10,000 FRW in one month (about 10 USD in 2021) to 5,000 FRW today; an index of work skills based on the use of technology and customer interaction from the World Bank STEP survey (Pierre et al. 2014); the number of uses listed for a pole, a measure of creativity; and whether the respondent started a community project, a measure of pro-social behavior emphasized in the entrepreneurship curriculum.[15] We find an increase of .09 standard deviations in grit in 2019, significant at 5 percent. The point estimate for 2021 is positive but not significant at conventional levels. We also find a statistically significant decline in creativity in 2019, with a similar but imprecise point estimate in 2021. We conclude there was no robust change in these skills in response to the program, consistent with the endline results.

The 2021 survey included a module on household formation, fertility, and gender attitudes. We examine the following outcomes, as specified in our analysis plan: marriage; children (any and number); age at first birth; desired fertility; home ownership; whether the respondent's partner completed secondary school; an empowerment index (defined for females only); and an index of progressive gender attitudes (defined for males only).[16] We present results in Table C.3, for the entire sample (Panel A) and separately for males and females (Panels B-C). We find only one significant treatment coefficient across all specifications and samples: a decline of 5 percentage points in female homeownership, significant at 10 percent. We conclude there is no robust evidence of changes in these outcomes related to household formation.

The endline results demonstrated increases in entrepreneurial activity in response to the program, before students completed secondary school. Did these effects persist after secondary school exit? Table 5 shows results for economic activity. In 2019, entrepreneurship increased 5.9 percentage points in response to the program, a 19 percent increase over the control mean, significant at 1 percent (Panel A, column 1). This magnitude is similar to the 5 percentage point increase observed at the endline, although the confidence interval remains below the expert prediction of +12 percentage points. Looking across other outcomes for 2019, we find that treated students were more likely to be involved in businesses originating in student clubs and outside agriculture.[17] Notably, the employment decreases observed at the endline (and in some calendar months of 2019; see Table 3, Panel E) were not distinguishable from zero in 2019. The proportion of respondents who were NEET (not in employment, education, or training) declined 3.6

[15] The community project appeared in the 2019 analysis plan but not 2021. We show results for both years for completeness. The discount rate was asked in the 2019 in person survey but not the phone survey, which explains the smaller number of observations. This is also true for the borrowing question (Table 5).

[16] The empowerment index is the mean of dummies for household head; making most financial decisions by self or jointly; decides whether to work outside home by self or jointly with spouse/partner; thinks most financial decisions should be made by self or jointly; and whether desired fertility is equal to or exceeds number of children. The progressive gender attitudes index is the mean of dummies for financial decisions made by wife or jointly and decision to work outside home should be made by female or jointly.

[17] In 2019, the most popular business types were agriculture (58 percent), food production or sales (19 percent), and retail shops (9 percent). In 2021, the most popular types were agriculture (45 percent), retail shops (14 percent), and food production or sales (9 percent). Other categories accounted for 5 percent or less in each year.

percentage points in the treatment group relative to the control, while those concurrently employed and in business rose 1.7 percentage points (although both these effects are significant only at 10 percent). Migration also increased by 5.1 percentage points in response to treatment.[18] Overall, Table 5, Panel A demonstrates increases in business and overall economic activity in response to the program in 2019, the year following secondary school exit.

However, the picture changes for 2021 (Table 5, Panel B). The increase in entrepreneurship has shrunk in magnitude and become imprecise. Treated students are significantly more likely to be in businesses originating from student clubs, suggesting networks of classmates were a source of economic resilience during the pandemic. However, treatment did not affect business survival between 2019 and 2021. Moreover, employment in the control group now exceeds the treatment group by 6.5 percentage points. These results are consistent with the calendar data (Table 3). The treatment coefficient on concurrent business and employment has flipped sign compared to 2019, and now reflects a 2.8 percentage point decrease in response to treatment. Migration in response to treatment persists, however, with an increased of 6.9 percentage points.

Figure 2 plots several of these outcomes over all rounds of data, with conventional confidence intervals shown for illustration. Overall, increases in economic activity driven by entrepreneurship in 2019 have largely dissipated and even reversed by 2021. We later check whether local COVID-19 prevalence helps to explain this pattern.

Table 6 reports results for continuous measures of economic activity. Profits, wages, savings, and income are all measured in 2021 USD. We winsorize these outcomes at the 99th percentile to diminish the role of outliers, as specified in the analysis plan. For profits, wages, and savings, we report effects unconditionally and conditional on entrepreneurship (in the case of profits), employment (for wages), and any savings. The unconditional effects represent the intent-to-treat (ITT) for the full sample. The conditional results limit the estimated effect to the intensive margin (i.e., profits among entrepreneurs) but at the cost of introducing potential sample selection in response to treatment. Panel A, column (1) shows the treatment effect on the unconditional mean of profits is indistinguishable from zero. Column (2) shows that the treatment effect for profits among those involved in business is also indistinguishable from zero for 2019. Similarly, we find no significant change in total income for 2019 (Panel A, column 8), though we find a significant decline of around 5 USD in savings among savers. Overall, we find little evidence of differences in economic welfare by treatment status in 2019.

Differences emerge in 2021, however (Table 6, Panel B). Here we find a drop of 22 USD in the unconditional mean of profits, significant only at 10 percent but large relative to the control mean of 3.5 USD. The decline in the conditional mean of profits is also large, 70 USD (column 2). However, a survey coding error may have introduced measurement errors into reported profits.[19]

[18] We define migration as an indicator for reporting one's permanent home is in a different district from the school attended at baseline. This outcome is exploratory.

[19] Respondents were asked to report the frequency of profit receipt, followed by the profit amount at the stated frequency. We then use the reported frequency to convert the amount into a measure of profits over two months. In the 2021 survey, a coding error introduced a discrepancy between the respondent's

An alternative measure of profits results in a zero treatment effect (column 3), giving us little confidence in the precision of the negative coefficients in columns 1-2. Nonetheless, we find declines in economic outcomes for the treatment group for measures that do not suffer from the same coding error. Wages (unconditional, monthly) fell by 9 USD, or 35 percent of the control mean (significant at 1 percent). In the past two months, overall income fell 5 USD, or 12 percent (significant at 10 percent). We fail to find evidence of differences in indices of physical assets or economic insecurity (columns 9-10).[20] We conclude that economic welfare did not increase, and by some measures grew worse, for the treatment group in 2021.

The OLS regressions in Table 6 measure average responses to treatment assignment, potentially missing changes in the tails of the distribution. If the treatment produces a few large businesses, for instance, high returns could be overlooked when focusing on mean outcomes. We risk exacerbating this problem by winsorizing large outcomes.

Figure 3 plots (log) economic outcome distributions without winsorizing to check this possibility. The horizontal axis shows the percentiles of each distribution by treatment status, with values on the vertical axis (log scale, labeled by levels in 2021 USD). The top row of the figure shows profits, income, and savings in 2019. In each case, the treatment and control distributions are nearly identical. However, by 2021 a gap emerges in the profit distribution, with higher profits for the control group starting around the median (first panel of bottom row). Control group income also lies above the treatment group for much of the distribution, while the savings distributions appear largely identical. In short, Figure 3 is consistent with the regression evidence from Table 6: the treatment group enjoys no greater economic welfare than the control group, with some measures showing lower welfare.

4.1.1 Robustness to selective attrition

A concern with our results is the potential for bias due to selective attrition. The treatment may have influenced both the outcomes of interest and the propensity to respond to our survey. For instance, if only the more economically successful students in the control group were willing to complete the survey, our results may exhibit bias against finding positive treatment effects. We use the post-double selection lasso specification in equations (1)-(3) to account for selection, but must rely on observable characteristics. Bias may persist if selection into the sample stems from unobserved characteristics.

To address this concern, we use data on the number of phone calls made to each respondent to balance our sample on the unobserved reluctance to respond, following the method of Behaghel et al. (2015). The intuition behind the procedure is that each potential respondent has a latent

reported profit frequency and the frequency stated back by the enumerator. For instance, respondents reporting receiving profits monthly were then asked to report weekly profits. The measure in column (2) converts profits to two months using the respondent's reported frequency. The measure in column (3) uses the enumerator's stated frequency.

[20] The economic insecurity index is proportion of 14 economic coping strategies used since start of pandemic, adapted from the evaluation of the Educate! SEED program in Uganda (Chioda et al. 2021). We thank the authors for graciously sharing the questionnaires with us.

threshold for responding to the survey, which may be affected by treatment. For instance, calling each potential respondent five times may achieve a 60 percent response rate in the treatment group, but only a 50 percent response rate in the control group. Using the full sample maximizes statistical power, but risks bias due to selective attrition, as reflected in the different response rates between groups. However, if reaching a 50 percent response rate in the treatment group requires only three calls, then limiting the treatment sample to this group balances the unobserved reluctance to respond between treatment and control. We re-analyze our data using this method to check the robustness of our results.

The 2021 data record the number of phone calls to each respondent, although this information is missing for some individuals. Fortunately, 2021 is also the round with the highest attrition rate. Table C.4 presents cumulative 2021 response rates by number of calls, separately for treatment and control. We first note that response rates are quite similar between groups, both overall and conditional on number of calls, suggesting bias due to selective attrition may be of limited practical concern in our context. We nonetheless balance response rates between groups by dropping from the sample all those with missing data on number of calls, and treated respondents with more than two calls.[21] This leaves a sample of 1,028 individuals, with nearly identical response rates between treatment (33.5 percent) and control (32.9 percent). We call this the balanced attrition sample. Using this sample, we repeat our analysis of outcomes for 2021.[22]

Our main findings are robust to analysis using the balanced attrition sample. In the monthly calendar data, we find increased university enrollment and decreased employment of similar magnitude and timing as in the full sample (Table C.5). Results for economic activity are very similar for the full and balanced attrition samples (Table C.6). For financial outcomes, results for the balanced attrition sample are noisier than for the full sample, with estimates for profits and income no longer statistically significant (Table C.7). However, the sign and magnitudes of these estimates closely follow the full sample. Overall, bias due to selective attrition is unlikely to explain our main findings.

4.2 Mechanisms

We find suggestive evidence of a decline in income in response to the program (Table 6). Why? This section reports exploratory results. One potential explanation is the increased university enrollment among treated students, which might reduce their capacity to generate income while studying. When dropping university students from the sample, our treatment effect estimates remain negative, though no longer precisely estimated for 2021.[23] University enrollment may

[21] Behaghel et al. (2015) recommend applying Lee bounds to the trimmed sample. We skip this step because incorporating covariates into Lee bounds requires calculating treatment effects within covariate cells, a task complicated by our use of the post-double selection lasso for covariate selection.
[22] For brevity, we report analogues of Tables 3, 5, and 6 for the balanced attrition sample. Additional results are available upon request.
[23] When dropping university students, the treatment coefficient is -2.2 (s.e. 1.4) for 2019. For 2021, the coefficient is -2.8 (3.3).

therefore partially explain decreases in income. Yet the failure of the program to increase income remains notable and worthy of further exploration.

Another candidate explanation is the impact of the COVID-19 pandemic. To explore this mechanism, we construct a dataset of district-level COVID-19 prevalence using the universe of cases and deaths recorded by the Rwanda Biomedical Center, scaled by district population from the most recent population census (2012). We merge this data with monthly calendar activity from the 2021 survey, matching students to the district of their school at baseline. Using this monthly student panel, we augment equation (1) to include COVID-19 prevalence (cases or deaths per thousand population) and its interaction with treatment. Because treatment was stratified by district, strata fixed effects account for time-invariant differences across districts. We also include month-by-year fixed effects to account for national conditions, allowing us to isolate the role of local variation in COVID-19 prevalence. Table 7 presents results.

We find modest evidence that COVID-19 prevalence mediated the response to treatment. COVID-19 deaths in the previous month at the sample mean (0.004 per thousand) are associated with a decline of -10.9 * 0.004 = -0.044 decrease in the proportion of treated students enrolled in university, a magnitude sufficient to undo the increase in university enrollment in the treatment group. However, the effect begins to reverse in the contemporaneous month. COVID-19 deaths in the previous month are also associated with an increase of similar magnitude in the proportion of treated students not economically active nor enrolled in school or training (NEET). However, COVID-19 deaths in Rwanda were relatively rare, and in our analysis were not associated with differential changes in entrepreneurship or employment in response to the program.

We also explore the impact of the pandemic on outcomes in the 2021 cross-section, measuring COVID-19 prevalence by cumulative cases and deaths per thousand district population since the onset of the pandemic. Table C.8 presents results, including outcomes for 2019 as a falsification test. The interaction terms between treatment and COVID-19 prevalence are not statistically significant for any 2021 outcome, including income. In sum, we find little evidence that the pandemic was a key mechanism for the medium-term results of the program. Nonetheless, variation in local COVID-19 prevalence may fail to capture this mechanism if the pandemic depressed economic activity in the aggregate.

Treatment may also have induced students with lower business experience or capacity into entrepreneurship. These marginal students might in turn earn lower income than their counterfactual career paths. In an RCT testing microcredit expansion in India, Banerjee et al. (2019) find heterogeneous effects between groups they call "gung-ho" and "reluctant" entrepreneurs. Reluctant entrepreneurs enter business due to microcredit expansion but benefit less than gung-ho entrepreneurs. Could a similar phenomenon have occurred in our context?

Consider a simple sectoral choice model. The agent's value v of choosing to run a business, expressed in monetary terms, is $v = y - c$, where y is business income and c is cost. Normalizing the value of the best outside option to zero, the agent chooses the business sector if $v \geq 0$, which

implies $y \geq c$. Let c include all costs of running a business, including operating costs, effort, and psychological costs.

The treatment T increased entrepreneurship without inducing a robust change in entrepreneurial or related skills. For instance, treatment may have facilitated business entry through the formation of student business clubs, meeting local entrepreneurs, or increasing the perceived utility of entrepreneurship. We can therefore model the treatment as a cost shifter, $c=c(T)$, where $c(1)<c(0)$, leaving y unchanged. The threshold y required to choose the business sector is therefore lower in the treatment group.

This simple model has two testable implications about selection into entrepreneurship. First, the treatment will increase entrepreneurship among those who would not otherwise have comparative advantage. Second, the treatment will reduce income among those induced into entrepreneurship.[24] In the model, the treatment reduces income because it lowers entrepreneurship entry costs rather than increasing skills which generate income. Empirically, the result will hold if the reduction in entry costs exceeds any income gains through increases in skills, or through foregone increases in skills relevant to the outside option.

To test the model, we look for heterogeneous effects between likely and unlikely entrepreneurs. We first predict contemporaneous entrepreneurship in the 2019 and 2021 samples, respectively, using baseline characteristics. We use the control group to fit two versions of the model, by lasso and ridge regression, using K-fold cross-validation with 10 folds. Applying the estimated parameters to the full sample, we interact treatment with an indicator for high (above median) probability entrepreneurs. This leaves the main effect as the estimated treatment effect for low probability entrepreneurs. We also use baseline entrepreneurship as an interaction term, following the proxy for gung-ho entrepreneurs in Banerjee et al (2019).

We present results in Table 8. In 2019, increased entrepreneurship in response to the program is concentrated among those *ex ante* less likely to be entrepreneurs or who were involved in business at baseline (Panel A, columns 1-3). Results for 2021 are more mixed, with results using predicted entrepreneurship from ridge regression showing a pattern similar to 2019 (Panel B, column 2), but not in the other specifications. Turning to income, in 2019 we find a decline in income of USD 3.1 (12 percent of the control mean) in response to treatment among low probability entrepreneurs, significant at 10 percent (Panel A, column 4). The treatment coefficient is also negative in other specifications for 2019, though not significant. For 2021, income declines are concentrated among low probability entrepreneurs and statistically significant across all specifications. By contrast, for high probability entrepreneurs in 2021, treatment effects on income vary in sign and are not distinguishable from zero (treatment plus interaction effects reported at bottom of table).

[24] Formally, let D be an indicator of business entry. If y is continuous with distribution function F, then the agent enters business with probability $\Pr(D=1) = 1 - F(c)$. Because $c(T=1) < c(T=0)$, then $\Pr(D=1, T=1) = 1 - F(c(1)) > 1 - F(c(0)) = \Pr(D=1, T=0)$.

The final three columns of Table 8 report results for profits. We find a similar pattern as for income, with negative though insignificant coefficients in 2019 and negative, significant effects in 2021 for low probability entrepreneurs. Given the potential measurement error in 2021 profits reported discussed in Section 4.2, we do not place high confidence on magnitudes for that year. Nonetheless, the qualitative pattern matches the results for income, which does not suffer from the same measurement error.[25]

Figure 4 presents results graphically, plotting outcomes against predicted entrepreneurship from the ridge regression model fit to the control group. Each panel shows outcome means within bins of predicted entrepreneurship, as well as local linear regression lines, separately by treatment status. At low levels of predicted entrepreneurship, treated students are more likely to enter entrepreneurship in both 2019 and 2021 (first column of the figure). At high levels of predicted entrepreneurship, the relationship reverses, matching the selection pattern found in Table 8. In other words, treatment effects are strongest among the reluctant entrepreneurs.

Income increases with predicted entrepreneurship for the control group (second column of Table 8). This positive gradient could explain the negative income effects we observed among reluctant entrepreneurs in Table 8. In fact, the figure shows treated students earn no more than control students throughout the predicted entrepreneurship distribution. The pattern of significantly lower income among reluctant entrepreneurs in the treatment group for 2021 is also apparent in the figure. Results for profits are similar to those for income in 2021. The negative selection story for income and profits is not as clear for 2019, but the regression results for this year are also imprecise.

Overall, the results are consistent with the simple model of selection into entrepreneurship in the absence of robust skill increases. The marginal students induced into entrepreneurship by the program may have chosen paths counter to their comparative advantage, with negative economic consequences, particularly in the adverse economic conditions of 2021.

4.3 Heterogeneous treatment effects

Did the program affect some students more than others? Our analysis plan specified checking for heterogeneous treatment effects by gender, normalized baseline (grade 9) exam score, and an indicator for being at or above the median on an index of baseline socioeconomic status (SES).[26] The pre-specified outcomes are university enrollment, entrepreneurship, employment, and income. We find little heterogeneity in treatment effects along these dimensions. University enrollment in response to treatment was concentrated among high-SES students and, for 2019, increasing in the baseline exam score. For entrepreneurship, we find a negative and marginally significant interaction between treatment and high SES in 2019, suggesting the program most effectively

[25] Results are qualitatively similar when dropping students enrolled in university at the time of each survey (Table C.9).
[26] We construct the SES index as the first principal component of household assets, parents' education, and indicator for parents in business or professional occupation.

converted lower-SES students into entrepreneurs. The effect had disappeared by 2021, however. We find no differential effects for any of the characteristics considered for employment or income. Results appear in Table C.10.

Increased university enrollment in response to treatment led us to conduct additional explotatory analysis for this outcome. Which types of students did the program induce to enroll in university? What are they studying? We first check whether university enrollment follows a selection pattern similar to entrepreneurship, by repeating the "gung-ho" and "reluctant" entrepreneur specification of the previous subsection. We find similar university enrollment responses to treatment among both types (shown by similar magnitudes or precision in the main and interacted effects of treatment; Table 9, columns 1-3). Next, we find that treatment led to increased university enrollment among academically stronger students, those in the top third of the secondary school exam distribution (columns 4-6). This result reconciles the paradox of decreased average secondary exam scores and increased university enrollment in response to the program. We fail to find evidence that the program increased university enrollment by increasing aspirations (as measured by strong agreement with the statement, "I have confidence that I will be admitted to university;" column 7). Finally, we find significant increases in business as a university course of study (columns 8-10).

In sum, the results imply the program increased university enrollment not by raising aspirations, but by convincing academically strong students to continue their studies, particularly in business. If these students go on to launch successful businesses, the program may therefore generate high returns in the long run.

5 Conclusion

We evaluate a secondary school entrepreneurship program in Rwanda, leveraging a randomized controlled trial of training program for its teachers. We focus on student outcomes one to three years after secondary school completion (i.e., three to five years after the program began). Entrepreneurship increased among treated students one year after secondary school, but faded after three years. After three years, employment is lower in the treatment group, with no robust change in total income. We find suggestive evidence that the program channeled students with lower business preparation or capacity into entrepreneurship. The program also did not lead to robust increases in measured skills. Nor did the program increase economic activity or welfare in the medium term, with lower income and profits among marginal students induced into entrepreneurship.

Although the program did not explicitly promote university enrollment, it nonetheless increased this outcome, particularly among academically strong students and in business programs. We also find increased internal migration in response to the program. Each of these outcomes—increased entrepreneurship, university enrollment, and migration—is consistent with students seeking greater autonomy in response to treatment.

Across the three academic years of program implementation, costs totaled 71 USD per student.[27] We find no return on student economic activity based on the three-year follow-up. The 5.9 percentage points increase in entrepreneurship in the one-year follow-up translates to one additional business per 17 treated students, or 1,203 USD per business generated. We find no significant changes in jobs created by these businesses, profits, or total income, suggesting the short-run economic returns were insufficient to cover these costs. We find a maximum increase in university enrollment of 4.5 percentage points across both follow-up survey waves (Table 3), or one additional university student per 22 treated students. The corresponding cost is 1,578 USD per additional university student, nearly double Rwanda's nominal per capita income of 820 USD in 2019 (World Bank 2020). In principle, the private returns to university attendance could exceed program costs as students reach mid-career.[28] Moreover, the increased migration in response to the program could reflect participants taking greater risks in search of economic opportunities, which could generate returns in the long run. However, if program benefits largely rest on university attendance, cost-effectiveness might increase further if the program focused directly on university preparation rather than entrepreneurship.

Beyond a narrow focus on cost effectiveness, we think the program offers lessons for implementation. In developing countries, effective teacher training programs are rare. Pedagogical change is difficult. This program delivered, at least partially, on its intention to modernize pedagogy and break "the tyranny of the curriculum." The program can also count some modest success in student outcomes, particularly in the short-term. Imperfect implementation and partial pedagogical change might be reasonable expectations among this first cohort of treated teachers, leaving ample room for program refinement and improvement in future iterations. The results highlight the substantial challenges faced by developing country policymakers wishing to reorient traditional education systems.

Our results also sound a note of caution about programs to promote youth entrepreneurship. The program did not deliver economic gains, at least in the medium-term, with suggestive evidence of income declines among those less likely *ex ante* to become entrepreneurs. Given heterogeneity in experience, ability, and the risks inherent in business creation, promoting entrepreneurship may result in adverse effects for some youth in low-income settings. Nonetheless, exposure to entrepreneurship training may encourage broader human capital investments, suggesting potential for higher returns in the long run.

[27] We base this calculation on total program cost of 4,730 USD and mean of 67 students in the entering cohort per treated school at baseline. Costs include program administration, targeting, staff and user training, implementation, user costs, averted costs, and monitoring, following the J-PAL cost effectiveness analysis template.

[28] For instance, suppose a treated student would earn 1,000 USD in the absence of university attendance, university attendance yields an annual return of 10 percent, students remain enrolled for three years, and the discount rate is 5 percent. The discounted private returns to university attendance would exceed program costs within ten years.

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7 Tables

Table 1: Attrition

	outcome: in sample			
	2019		2021	
	(1)	(2)	(3)	(4)
treatment	0.010	-0.081	0.005	-0.148
	(0.016)	(0.105)	(0.022)	(0.136)
treatment interacted with:				
female		-0.002		-0.030
		(0.029)		(0.040)
household assets		-0.072		0.114
		(0.105)		(0.138)
mother completed primary school		0.007		-0.008
		(0.028)		(0.036)
repeating S4		-0.075		-0.071
		(0.071)		(0.089)
S3 exam score (aggregate)		0.002		0.001
		(0.001)*		(0.002)
employed during school holiday		-0.028		-0.019
		(0.033)		(0.043)
understands compound interest		0.009		-0.015
		(0.027)		(0.040)
has savings		0.002		-0.025
		(0.030)		(0.042)
can calculate business profit		-0.054		-0.032
		(0.028)*		(0.036)
wants to enroll in post-secondary		-0.009		0.075
		(0.032)		(0.046)
plans to start a business		0.043		-0.073
		(0.029)		(0.045)
grit index		-0.001		0.039
		(0.015)		(0.020)*
N	3,095	2,983	3,095	2,983
control mean	0.84	0.84	0.49	0.50
p-value of joint test	0.52	0.40	0.82	0.43

Table reports coefficients from regression of indicator for survey response on treatment and interactions between treatment and baseline characteristics. Main effects of baseline characteristics and strata fixed effects included in all regressions. Household asset index is proportion of items owned among radio, television, telephone, refrigerator, bicycle, motorcycle, and automobile. Grit index is mean response on 1-5 scale (1=most, 5=least) to four items about passion and perseverance in pursuit of goals. Standard errors in parenthesis, clustered by school. Final row reports p-value of joint test of null hypothesis that all coefficients=0. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 2: Baseline balance, 2019 and 2021 samples

	2019			2021		
	control	treatment	difference	control	treatment	difference
	(1)	(2)	(1)-(2)	(4)	(5)	(4)-(5)
female	0.55	0.64	-0.09***	0.56	0.64	-0.08***
	[0.66]	[0.66]		[0.67]	[0.67]	
household assets	0.29	0.29	0.00	0.30	0.31	-0.01
	[0.28]	[0.30]		[0.22]	[0.26]	
mother completed primary school	0.55	0.58	-0.03*	0.58	0.62	-0.04
	[0.64]	[0.65]		[0.60]	[0.59]	
repeating S4	0.03	0.04	-0.01	0.04	0.04	-0.00
	[0.23]	[0.21]		[0.21]	[0.20]	
S3 exam score (aggregate)	53.2	52.8	0.4	52.6	51.6	1.1
	[29.8]	[36.9]		[27.0]	[33.8]	
employed during school holiday	0.28	0.23	0.05**	0.28	0.23	0.05*
	[0.63]	[0.62]		[0.55]	[0.55]	
understands compound interest	0.67	0.64	0.04	0.69	0.63	0.05*
	[0.56]	[0.73]		[0.52]	[0.61]	
has savings	0.33	0.29	0.03	0.37	0.33	0.04
	[0.71]	[0.71]		[0.69]	[0.64]	
can calculate business profit	0.56	0.50	0.06*	0.58	0.54	0.05
	[0.79]	[0.80]		[0.68]	[0.66]	
wants to enroll in post-secondary	0.72	0.74	-0.02	0.73	0.78	-0.05*
	[0.64]	[0.72]		[0.60]	[0.65]	
plans to start a business	0.76	0.78	-0.02	0.78	0.77	0.01
	[0.48]	[0.54]		[0.46]	[0.50]	
grit index (1-5, 1 is most grit)	2.88	2.99	-0.11**	2.86	3.04	-0.18***
	[1.16]	[1.24]		[1.02]	[1.22]	
Schools	104	103		104	101	
Students	1,311	1,313		765	765	

Samples are students surveyed in 2019 and 2021 tracer surveys, as indicated. Data from baseline survey, conducted February-March 2016. Columns (1)-(2) and (4)-(5) show means by treatment status. Standard deviation in parenthesis, clustered by school. Columns (3) and (6) show difference between respective control and treatment groups, adjusting for stratification of treatment and clustering standard error by school. Household asset index is proportion of items owned among radio, television, telephone, refrigerator, bicycle, motorcycle, and automobile. Grit index is mean response on 1-5 scale (1=most, 5=least) to four items about passion and perseverance in pursuit of goals. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 3: Calendar activity, 2019-2021

Year	2019						2020			2021	
Month	January	February	March	April	May	June	February	May	November	February	July/August
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Panel A: secondary school											
Treatment	0.002	-0.004	-0.004	-0.005	-0.003	-0.001	-0.001	-0.002	0.002	-0.001	-0.005
	(0.011)	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	(0.006)	(0.004)	(0.005)	(0.007)	(0.006)
Control mean	0.06	0.07	0.07	0.07	0.07	0.07	0.02	0.01	0.01	0.02	0.02
Panel B: university											
Treatment	-0.002	-0.003	0.003	0.006	0.004	0.005	0.041	0.038	0.035	0.045	0.040
	(0.002)	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.016)**	(0.013)***	(0.015)**	(0.018)**	(0.019)**
Control mean	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.06	0.07	0.11	0.14
Panel C: vocational (TVET)											
Treatment	0.014	0.003	0.006	0.002	-0.005	-0.001	-0.007	-0.012	-0.008	0.002	0.008
	(0.007)*	(0.010)	(0.012)	(0.013)	(0.012)	(0.010)	(0.011)	(0.009)	(0.008)	(0.009)	(0.008)
Control mean	0.03	0.06	0.08	0.08	0.09	0.07	0.06	0.04	0.03	0.03	0.02
Panel D: business											
Treatment	0.065	0.067	0.045	0.050	0.063	0.064	-0.009	0.002	0.018	0.010	0.023
	(0.017)***	(0.018)***	(0.018)**	(0.020)**	(0.018)***	(0.018)***	(0.024)	(0.023)	(0.023)	(0.022)	(0.026)
Control mean	0.23	0.30	0.35	0.38	0.38	0.33	0.32	0.31	0.30	0.31	0.35
Panel E: employed											
Treatment	-0.025	-0.031	-0.022	-0.026	-0.013	-0.029	-0.059	-0.062	-0.019	-0.040	-0.055
	(0.011)**	(0.013)**	(0.015)	(0.016)	(0.017)	(0.015)*	(0.020)***	(0.021)***	(0.021)	(0.021)*	(0.023)**
Control mean	0.12	0.17	0.20	0.24	0.24	0.21	0.23	0.22	0.23	0.28	0.33
N	2,624	2,624	2,624	2,624	2,624	2,624	1,530	1,530	1,530	1,530	1,530

Outcomes from student tracer phone survey 2019 and 2021, based on calendar recall data of monthly activity. Data for 2019 from 2019 tracer survey. Data for 2020-2021 from 2021 tracer survey. All regressions control for randomization strata, with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Skills

	secondary exit exam	grit	belief in future	entrepreneurial spirit	monthly discount rate<100%	work skills	creativity	started community project
	(1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: 2019								
treatment	-0.091	0.092	0.023	0.031	0.025	0.053	-0.094	0.014
	(0.055)*	(0.036)**	(0.037)	(0.037)	(0.026)	(0.060)	(0.042)**	(0.009)
N	2,127	2,624	2,624	2,624	383	1,072	2,624	2,624
Control mean	0.00	0.00	0.00	0.00	0.07	0.00	2.31	0.08
Panel B: 2021								
treatment	N/A	0.067	0.018	-0.018	-0.005	-0.005	-0.089	0.007
		(0.050)	(0.048)	(0.050)	(0.017)	(0.049)	(0.071)	(0.006)
N		1,530	1,530	1,530	1,530	1,530	1,530	1,469
Control mean		0.00	0.00	0.00	0.12	0.00	2.98	0.01
endline mean (T)	N/A	-0.01	N/A	N/A	0.15	N/A	N/A	N/A
endline mean (C)	N/A	0.00	N/A	N/A	0.14	N/A	N/A	N/A
baseline mean	0.00	-0.06	-0.02	N/A	0.26	N/A	N/A	N/A

Samples are 2019/2021 student tracer surveys, as indicated. Table shows regression of indicated outcome on treatment, controlling for baseline outcome where available. Outcome means from control group within sample reported at bottom of each panel. Exam score (column 1) is z-score from survey self-report, standardized to control mean. Entrepreneurial spirit uses scale from Bruhn et al (2018). Work skills drawn from 5 items on use of technology and interaction with customers. Belief in future uses subscale from Chinese Positive Youth Development Scale (Shek et al 2007). Grit uses 4-item scale for baseline and endline, 12-item scale for 2019 and 2021 tracer. Entrepreneurial spirit, work skills, belief in future, and grit all reported as z-scores, standardized to control mean. Monthly discount rate<100% based on stated preference for 10K FRW one month from now rather than 5K FRW today (2019 version asked only for in-person survey). Creativity is number of uses of pole listed. Baseline outcome included for belief in future is locus of control. All regressions control for randomization strata, with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Regression for exam score includes lower secondary exit exam score without penalty. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Endline means for treatment (T) and control (C) and overall baseline mean reported at bottom of table. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Economic activity

	entrepreneurship		business characteristics		borrowed	business	employed	business	NEET	business	migration
	all	student club	non-agricultural	has paid employees	for business	survived since 2019		or employment		and employment	(exploratory)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Panel A: 2019											
treatment	0.059	0.012	0.031	0.010	0.055	N/A	-0.019	0.018	-0.036	0.017	0.051
	(0.018)***	(0.004)***	(0.012)**	(0.010)	(0.041)		(0.018)	(0.020)	(0.019)*	(0.009)*	(0.028)*
N	2,624	2,624	2,624	2,624	383		2,624	2,624	2,624	2,624	2,624
Control mean	0.31	0.01	0.11	0.08	0.27		0.31	0.56	0.41	0.06	0.28
Panel B: 2021											
treatment	0.012	0.035	0.021	-0.002	-0.047	0.002	-0.065	-0.028	-0.010	-0.028	0.069
	(0.024)	(0.015)**	(0.018)	(0.014)	(0.024)*	(0.012)	(0.025)***	(0.026)	(0.022)	(0.011)**	(0.032)**
N	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530
Control mean	0.31	0.08	0.16	0.08	0.48	0.07	0.43	0.66	0.23	0.08	0.34
endline mean (T)	0.33	0.04	0.09	0.07	0.49	N/A	0.14	0.41	0.04	0.02	N/A
endline mean (C)	0.30	0.01	0.09	0.07	0.54	N/A	0.19	0.43	0.03	0.03	N/A
baseline mean	0.22	0.00	0.04	0.22	0.23	N/A	0.13	0.25	N/A	0.10	N/A

Samples are 2019 and 2021 student tracer surveys, as indicated. Table shows regression of indicated outcome on treatment, controlling for baseline outcome where available. Outcome means from control group within sample reported at bottom of each panel. "Borrowed for business" includes attempts to borrow (2019 version asked only for in-person survey). NEET refers to not in employment, education, or training. Migration is indicator for reporting permanent home in different district from school attended at baseline. All regressions control for randomization strata, with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Endline means for treatment (T) and control (C) and overall baseline mean reported at bottom of table. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Income and economic security

source		Profit		wages		savings		total income	assets (z)	economic insecurity (0-1)
conditional?	no	yes	yes (alt.)	no	yes	no	yes	no	no	no
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: 2019										
treatment	0.8	-6.6	N/A	N/A	N/A	-2.3	-5.4	-2.1	N/A	N/A
	(2.1)	(6.2)				(1.8)	(2.4)**	(1.4)		
N	2,624	855				2,624	1,873	2,624		
Control mean	3.2	54.2				28.5	40.5	26.7		
Panel B: 2021										
treatment	-22.6	-70.8	4.6	-9.4	-13.6	-0.5	-1.2	-5.6	0.059	-0.008
	(12.8)*	(32.8)**	(11.8)	(3.6)***	(8.7)	(6.4)	(8.2)	(3.1)*	(0.048)	(0.007)
N	1,530	464	464	1,530	590	1,530	1,124	1,529	1,455	1,530
Control mean	3.5	196.4	80.3	26.6	61.9	64.0	88.4	46.9	0.00	0.23
endline mean (T)	7.7	26.8	N/A	N/A	N/A	15.7	24.5	7.8	N/A	N/A
endline mean (C)	10.7	40.9	N/A	N/A	N/A	18.7	29.6	9.3	N/A	N/A
baseline mean	2.8	4.5	N/A	N/A	N/A	N/A	N/A	1.7	N/A	N/A

Samples are 2019 and 2021 student tracer surveys, as indicated. Table shows regression of indicated outcome on treatment, controlling for baseline outcome where available. Outcome means from control group within sample reported at bottom of each panel. Financial outcomes measured in USD (real terms, 2021 Q3), winsorized at 99th percentile. "Conditional" refers to participation in indicated activity, e.g., profits conditional on entrepreneurship, wages conditional on employment, savings conditional on any savings. If "conditional" is no, then outcome is unconditional distribution, with zero imputed for respondents not involved in respective activity. Business sales and profits adjusted by reported frequency of business earnings to estimate profits over two months. Alternative profit measure uses alternative adjustment for reported frequency based on coding error in 2021 survey. Wages adjusted by reported frequency to estimate monthly wage. Asset index is z-score of 1st principal component of indicators for ownership of 12 different physical assets, including livestock, vehicles, computer, and house. Economic insecurity index is proportion of 14 economic coping strategies used since start of pandemic. Savings regressions (columns 6-7) control for dummies of savings reported in intervals. All regressions control for randomization strata, with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Endline means for treatment (T) and control (C) and overall baseline mean reported at bottom of table. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Calendar activity and COVID-19 prevalence, monthly panel 2020-2021 (exploratory)

outcome	University		business		employment		NEET	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: cases (per thousand)								
treatment	0.04	0.03	0.01	0.02	-0.05	-0.05	-0.01	-0.01
	(0.01)***	(0.01)**	(0.02)	(0.02)	(0.02)**	(0.02)**	(0.02)	(0.02)
treatment interacted with:								
cases(t)	0.01	-0.01	0.00	0.02	-0.01	-0.01	-0.01	-0.03
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
cases(t-1)		0.03		-0.05		0.01		0.04
		(0.03)		(0.03)		(0.03)		(0.03)
N	7,650	7,650	7,650	7,650	7,650	7,650	7,650	7,650
Mean outcome (control)	0.10	0.10	0.32	0.32	0.26	0.26	0.43	0.43
Mean cases/thousand	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Panel B: deaths (per thousand)								
treatment	0.04	0.04	0.01	0.01	-0.04	-0.05	-0.01	-0.02
	(0.01)**	(0.01)***	(0.02)	(0.02)	(0.02)**	(0.02)**	(0.02)	(0.02)
treatment interacted with:								
deaths(t)	1.6	3.5	-0.7	-1.2	-1.0	-1.2	-0.3	-2.0
	(0.9)*	(0.9)***	(1.1)	(1.3)	(1.0)	(1.1)	(1.0)	(1.3)
deaths(t-1)		-10.9		2.6		1.7		9.2
		(3.0)***		(4.4)		(3.9)		(3.6)**
N	7,650	7,650	7,650	7,650	7,650	7,650	7,650	7,650
Mean outcome (control)	0.10	0.10	0.32	0.32	0.26	0.26	0.43	0.43
Mean cases/thousand	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004

Sample is respondents 2021 student tracer survey, monthly panel using calendar recall data for February/May/November 2020, February/July 2021. Table shows regression of indicated outcome on treatment and interaction with district-level COVID-19 prevalence. Observations assigned to district of their baseline secondary school. COVID-19 prevalence measured in cases (Panel A) or deaths (Panel B) per thousand population from 2012 Census. NEET refers to "not in employment, education, or training," inclusive of enrollment in secondary school, TVET, or university, and entrepreneurship or paid employment. All regressions control for randomization strata, main effect of terms interacted with treatment, and month-year fixed effects, with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Outcome means from control group and COVID-19 prevalence within sample reported at bottom of each panel. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8: Selection into entrepreneurship (exploratory)

	business participation			income			profit		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: 2019									
treatment	0.07	0.08	0.06	-3.1	-1.3	-1.6	-8.2	-3.4	-1.5
	(0.02)***	(0.02)***	(0.02)***	(1.9)*	(2.0)	(1.6)	(11.7)	(13.5)	(7.6)
treatment*high Pr(entrepreneur)	-0.04	-0.05		1.7	-2.0		2.2	-5.5	
	(0.03)	(0.03)		(3.0)	(3.2)		(14.2)	(15.5)	
treatment*business at baseline			0.01			-1.9			-16.7
			(0.04)			(3.9)			(13.1)
N	2,624	2,624	2,624	2,624	2,624	2,624	855	855	855
treatment + interaction	0.03	0.03	0.07	-1.4	-3.2	-3.6	-6.0	-8.9	-18.2
p(treatment + interaction)	0.18	0.22	0.09	0.52	0.15	0.31	0.42	0.19	0.08
Control mean	0.31	0.31	0.31	26.7	26.7	26.7	54.2	54.2	54.2
Panel B: 2021									
treatment	-0.01	0.06	-0.01	-6.0	-7.0	-6.9	-96.3	-171.7	-98.9
	(0.03)	(0.03)*	(0.03)	(3.3)*	(3.6)*	(3.3)**	(49.2)*	(60.6)***	(45.0)**
treatment*high Pr(entrepreneur)	0.09	-0.10		3.7	2.7		28.5	136.7	
	(0.06)	(0.05)**		(7.4)	(5.8)		(104.8)	(77.3)*	
treatment*business at baseline			0.10			8.6			38.5
			(0.06)			(8.1)			(109.9)
N	1,530	1,530	1,530	1,529	1,529	1,529	464	464	464
treatment + interaction	0.08	-0.04	0.09	-2.3	-4.3	1.6	-67.8	-35.0	-60.3
p(treatment + interaction)	0.12	0.24	0.11	0.73	0.37	0.83	0.38	0.43	0.49
Control mean	0.31	0.31	0.31	46.9	46.9	46.9	196.4	196.4	196.4
Pr(entrepreneurship) by CV lasso (L) or ridge (R)	L	R	NA	L	R	NA	L	R	NA

Samples are 2019 and 2021 student tracer surveys, as indicated. Income and profit measured in USD (real terms, 2021 Q3) from last two months, winsorized at 99th percentile. High Pr(entrepreneur) is indicator for above median probability of contemporaneous entrepreneurship calculated by cross-validated lasso or ridge regression model (10 folds) using control group sample. Additional candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes and squared terms of continuous measures. Outcome mean from control group within sample reported at bottom of each panel. All regressions control for main effect of interaction term, randomization strata, and baseline outcome. Additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

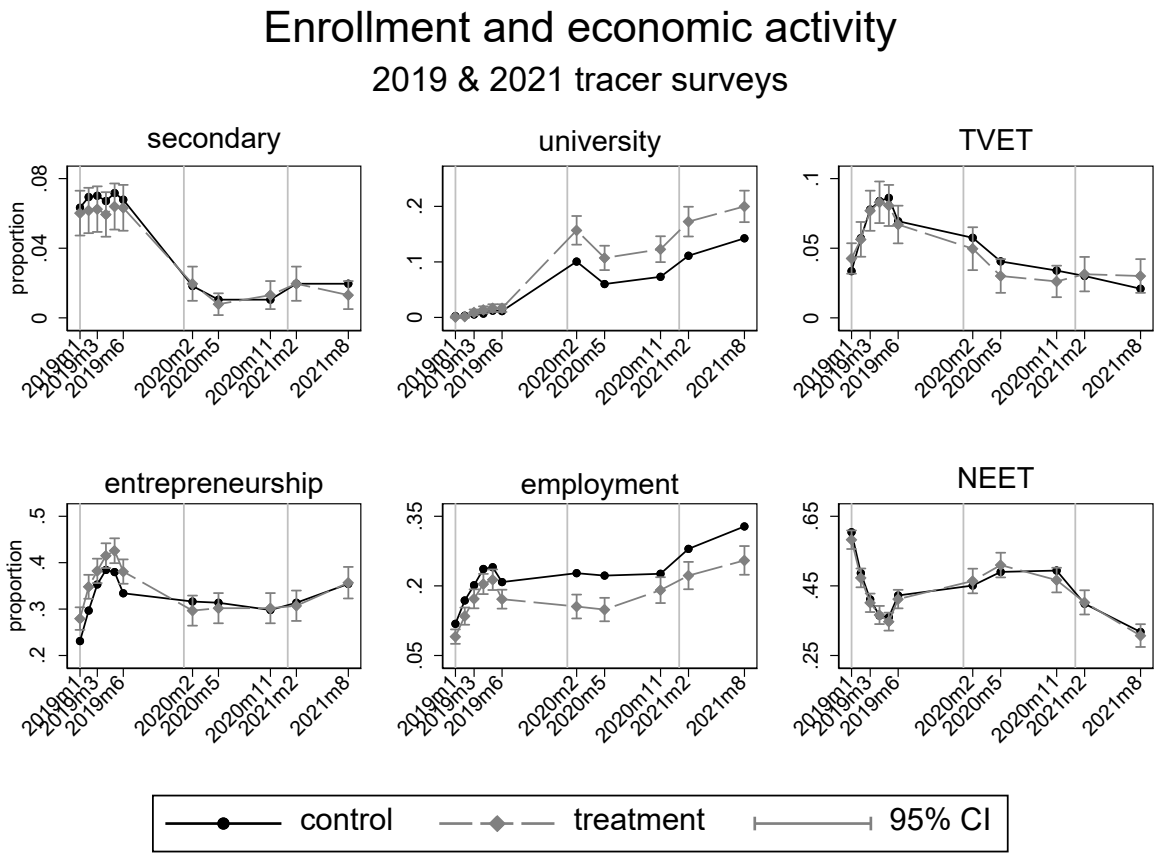
Table 9: University enrollment (exploratory)

	university enrollment									
	by Pr(entrepreneurship)			by secondary exam tercile			aspirations	by course of study		
	CV lasso	ridge	business at baseline	low	middle	high		business/ finance	education/ nursing	ICT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: 2019										
treatment	0.03	0.03	0.03	0.003	0.03	0.12	-0.01	0.012	0.003	0.008
	(0.01)**	(0.02)*	(0.01)**	(0.01)	(0.01)*	(0.03)***	(0.02)	(0.006)*	(0.004)	(0.004)*
treatment*high Pr(entrepreneur)	0.01	0.004								
	(0.02)	(0.02)								
treatment*business at baseline			0.01							
			(0.02)							
N	2,624	2,624	2,624	712	814	601	2,624	2,624	2,624	2,624
treatment + interaction	0.03	0.03	0.04							
p(treatment + interaction)	0.01	0.00	0.02							
Control mean	0.04	0.04	0.04	0.01	0.03	0.12	0.26	0.020	0.010	0.000
Panel B: 2021										
treatment	0.02	0.03	0.01	-0.02	0.03	0.10	0.01	0.025	0.003	0.008
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.05)**	(0.02)	(0.013)*	(0.008)	(0.008)
treatment*high Pr(entrepreneur)	-0.01	-0.03								
	(0.04)	(0.03)								
treatment*business at baseline			0.01							
			(0.04)							
N	1,530	1,530	1,530	365	443	337	1,530	1,530	1,530	1,530
treatment + interaction	0.01	0.00	0.02							
p(treatment + interaction)	0.86	0.98	0.51							
Control mean	0.15	0.15	0.15	0.03	0.10	0.44	0.25	0.030	0.030	0.020

Samples are 2019 and 2021 student tracer surveys, as indicated. University enrollment from survey measure in indicated year. In columns (1)-(2), high Pr(entrepreneur) is indicator for above median probability of contemporaneous entrepreneurship calculated by cross-validated lasso model (10 folds) using control group sample. Columns (4)-(6) split sample by tercile of control group distribution of secondary school exam score. Outcome in column (7) is indicator for "strongly agree" in response to the statement, "I have confidence that I will be admitted to university." Outcomes in columns (8)-(10) are university course of study. Business/finance (column 8) includes all business-related programs, including business, finance, accounting, and marketing. ICT (column 10) is information and communication technology. Additional candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes and squared terms of continuous measures. Outcome mean from control group within sample reported at bottom of each panel. All regressions control for main effect of interaction term and randomization strata. Additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%, based on conventional p-values.

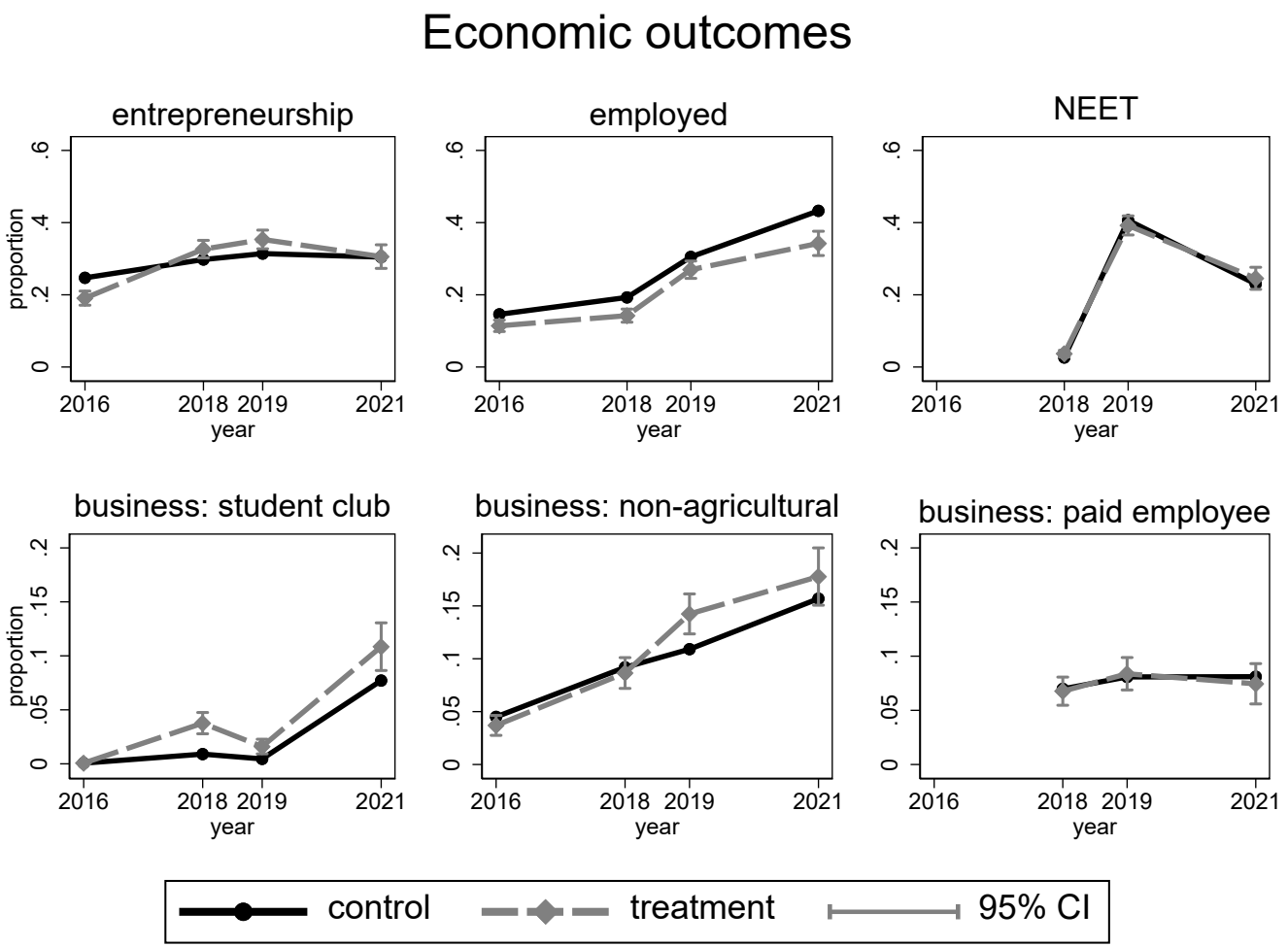
8 Figures

Figure 1: Calendar activity, 2019-2021



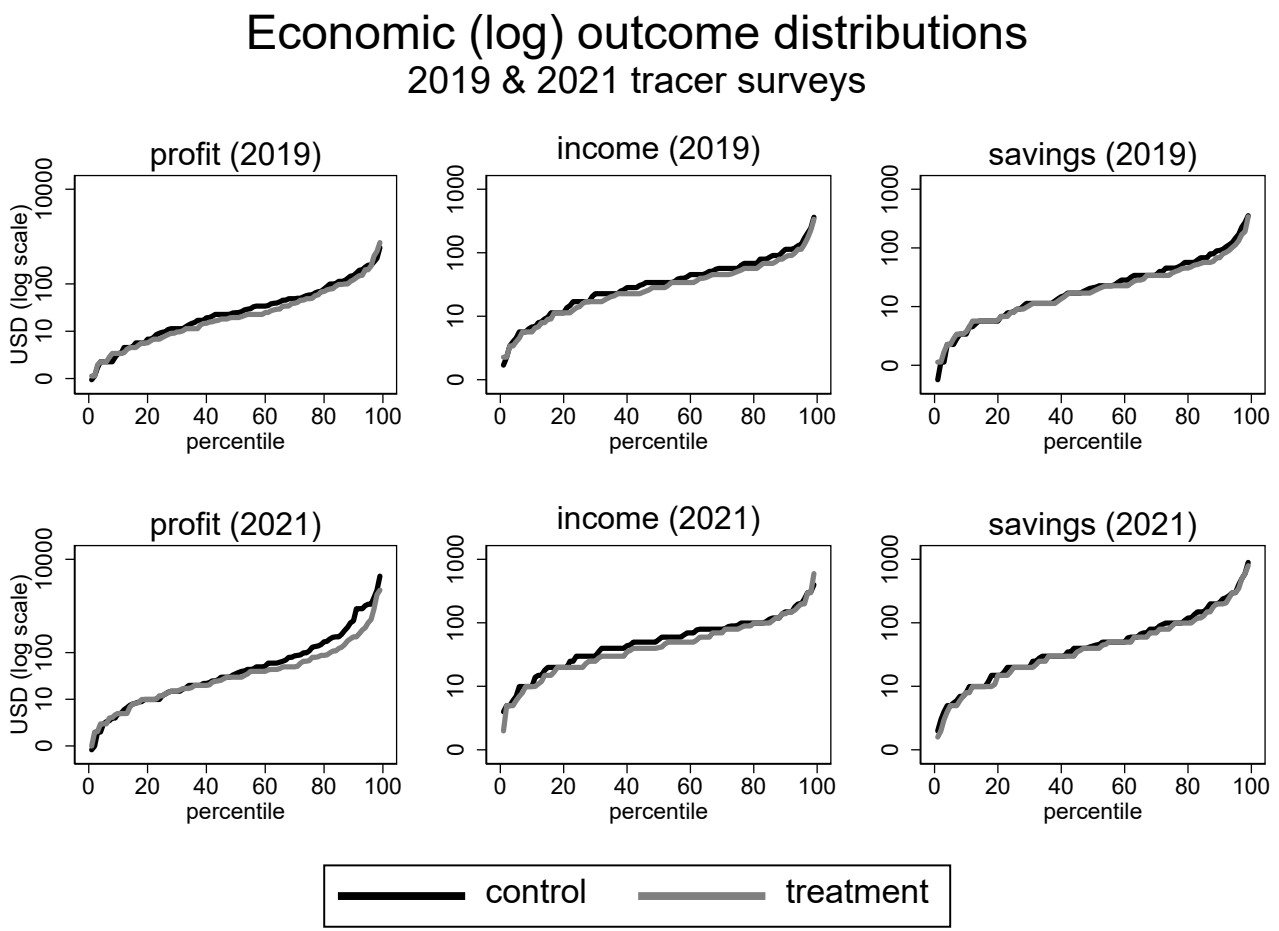
Graph shows means of each outcome by treatment status. 95% confidence interval for treatment group also shown. Secondary, university, and TVET refer to enrollment in each type of program. NEET corresponds to no participation in all categories shown. All data uses calendar recall data. Data from 2019 from 2019 tracer survey. Data from 2020-2021 from 2021 tracer survey.

Figure 2: Economic outcomes



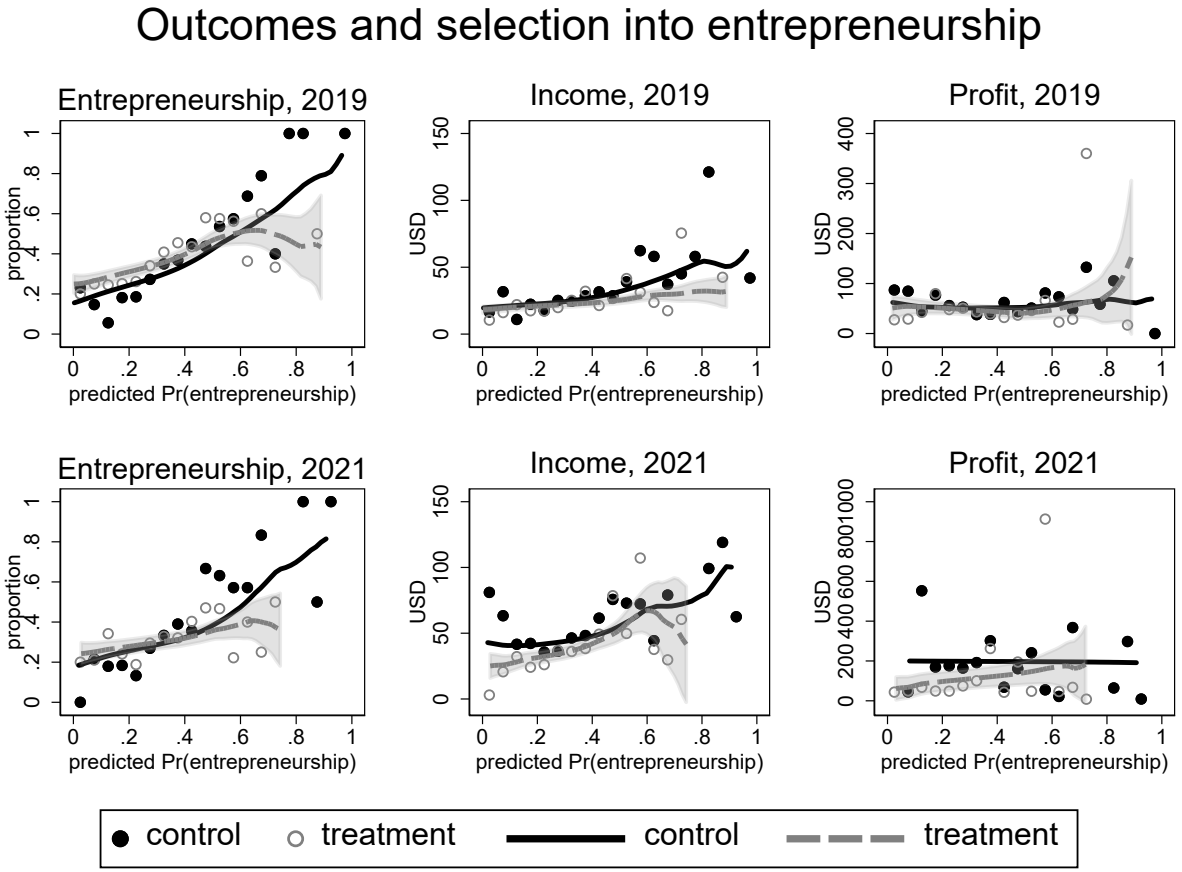
Graph shows means of each outcome by treatment status. 95% confidence interval for treatment group also shown. NEET refers to "not in employment, education, or training.

Figure 3: Economic outcome distributions, 2019 and 2021



Graph plots values of variable against corresponding percentile within treatment or control distribution. All variables measured in natural log, with levels (USD 2021) reported on y-axis. Profits and income from previous two months. Not winsorized.

Figure 4: Outcomes and selection into entrepreneurship



Graphs plot outcomes against binned values of predicted entrepreneurship, by treatment status. Local linear regressions, with 95 percent confidence interval for treatment group, also shown. Predicted Pr(entrepreneur) from horizontal axis calculated from model of contemporaneous entrepreneurship estimated by cross-validated ridge regression model (10 folds) using control group sample. Model includes baseline business ownership and randomization strata. Additional candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes and squared terms of continuous measures. Income and profit measured in USD (real terms, 2021 Q3) from last two months, winsorized at 99th percentile.

Unintended Consequences of Youth Entrepreneurship Programs: Experimental Evidence from Rwanda
Moussa Blimpo and Todd Pugatch
Online Appendix

A. Populated Analysis Plan: 2019 survey

Table A.1: Survey completion, 2019

sample	control			treatment			difference
survey	baseline	endline	tracer 2019	baseline	endline	tracer 2019	tracer 2019
	(1)	(2)	(3)	(4)	(5)	(6)	(6)-(3)
overall	N/A	0.93	0.84	N/A	0.93	0.85	0.01
		[0.36]	[0.45]		[0.54]	[0.55]	
phone survey	N/A	N/A	0.84	N/A	N/A	0.85	0.01
			[0.45]			[0.55]	
in-person survey	N/A	N/A	0.13	N/A	N/A	0.12	-0.01
			[0.56]			[0.44]	
Schools	104	104	104	103	103	103	
Students	1,554	1,447	1,311	1,541	1,433	1,313	

Outcomes from student tracer survey 2019, endline survey 2018, and baseline survey 2016 (where available). Columns (1)-(6) show means by treatment status. Standard deviation in parenthesis, clustered by school. Column (7) shows difference between (3) and (6), adjusting for stratification of treatment and clustering standard error by school. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A.2: Calendar activity, academic (2019)

enrollment	Secondary school			university			Vocational (TVET)		
	control	treatment	difference	control	treatment	difference	control	treatment	difference
	(1)	(2)	(2)-(1)	(4)	(5)	(5)-(4)	(7)	(8)	(8)-(7)
January	0.063	0.060	-0.003	0.002	0.001	-0.002	0.034	0.043	0.009
	[0.284]	[0.294]		[0.047]	[0.028]		[0.183]	[0.212]	
February	0.069	0.062	-0.008	0.003	0.002	-0.002	0.057	0.056	-0.001
	[0.297]	[0.289]		[0.054]	[0.039]		[0.255]	[0.266]	
March	0.070	0.062	-0.008	0.005	0.009	0.004	0.078	0.077	-0.001
	[0.296]	[0.288]		[0.081]	[0.106]		[0.305]	[0.304]	
April	0.067	0.059	-0.008	0.007	0.014	0.007*	0.084	0.083	-0.001
	[0.294]	[0.263]		[0.089]	[0.132]		[0.312]	[0.320]	
May	0.072	0.064	-0.008	0.012	0.017	0.005	0.086	0.081	-0.005
	[0.303]	[0.297]		[0.129]	[0.154]		[0.307]	[0.285]	
June	0.068	0.063	-0.005	0.011	0.017	0.005	0.069	0.067	-0.002
	[0.301]	[0.297]		[0.126]	[0.164]		[0.263]	[0.268]	
Schools	104	103		104	103		104	103	
Students	1,311	1,313		1,311	1,313		1,311	1,313	

Outcomes from student tracer phone survey 2019, based on calendar recall data of enrollment by level of schooling. Standard deviation in parenthesis, clustered by school. Differences reported in columns 3/6/9 adjust for stratification of treatment and cluster standard error by school. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A.3: Calendar activity, economic (2019)

activity	business			employment			employment (unpaid)		
	control	treatment	difference	control	treatment	difference	control	treatment	difference
	(1)	(2)	(2)-(1)	(4)	(5)	(5)-(4)	(7)	(8)	(8)-(7)
January	0.23	0.28	0.05***	0.12	0.09	-0.03***	0.03	0.03	0.001
	[0.46]	[0.54]		[0.31]	[0.31]		[0.16]	[0.18]	
February	0.30	0.35	0.05***	0.17	0.14	-0.03***	0.04	0.04	0.01
	[0.47]	[0.62]		[0.38]	[0.35]		[0.18]	[0.20]	
March	0.35	0.38	0.03	0.20	0.17	-0.03**	0.05	0.05	0.001
	[0.51]	[0.57]		[0.38]	[0.42]		[0.19]	[0.23]	
April	0.38	0.42	0.03	0.24	0.20	-0.03**	0.04	0.05	0.02**
	[0.56]	[0.59]		[0.41]	[0.46]		[0.19]	[0.22]	
May	0.38	0.43	0.05**	0.24	0.21	-0.03*	0.05	0.06	0.01
	[0.54]	[0.57]		[0.44]	[0.50]		[0.22]	[0.23]	
June	0.33	0.38	0.05**	0.21	0.17	-0.04***	0.03	0.05	0.01**
	[0.54]	[0.56]		[0.40]	[0.43]		[0.19]	[0.23]	
Schools	104	103		104	103		104	103	
Students	1,311	1,313		1,311	1,313		1,311	1,313	

Outcomes from student tracer phone survey 2019, based on calendar recall data. Standard deviation in parenthesis, clustered by school. Differences in columns 3/6/9 adjust for stratification of treatment and cluster standard error by school. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A.4: Academic outcomes, 2019

	completed secondary	S6 exam score	enrollment university	enrollment TVET
	(1)	(2)	(3)	(4)
treatment	0.000	-0.094	0.040	0.000
	(0.019)	(0.055)*	(0.013)***	(0.006)
N	2,624	2,127	2,624	2,624
R-squared	0.02	0.36	0.04	0.01
Control mean	0.82	0.00	0.04	0.03
Baseline mean	N/A	-0.15	N/A	N/A

Sample is 2019 student tracer phone survey. Table shows regression of indicated outcome on treatment, including baseline outcome where indicated. Baseline outcome set to control mean if missing, with indicator for missing value included in regression. All regressions control for randomization strata. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.5: Entrepreneurial and workplace skills, 2019

	entrepreneurial spirit		work autonomy	customer contact	supervisor	computer use	creativity: # uses of pole	Prefer in one month to 5k FRW today		started community project
	z-score	principal component						10K FRW	20k FRW	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
treatment	0.01	-0.03	-0.03	0.01	-0.06	0.004	-0.13	0.03	0.10	0.01
	(0.04)	(0.05)	(0.06)	(0.02)	(0.03)**	(0.02)	(0.04)***	(0.03)	(0.04)**	(0.01)
N	2,624	2,624	1,072	1,072	1,072	1,072	2,624	383	383	2,624
R-squared	0.01	0.01	0.02	0.02	0.03	0.05	0.02	0.14	0.12	0.01
Control mean	0.00	0.01	0.00	0.88	0.34	0.10	2.31	0.07	0.24	0.08
Endline mean (T)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.15	0.36	0.14
Endline mean (C)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.14	0.32	0.09
Baseline mean	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.26	0.43	N/A

Sample is 2019 student tracer phone survey, except time preference outcomes (columns 8-9), which are from in-person survey. Table shows regression of indicated outcome on treatment, including baseline outcome where indicated. Baseline outcome set to control mean if missing, with indicator for missing value included in regression. All regressions control for randomization strata. Entrepreneurial spirit uses scale from Bruhn et al (2018). Work autonomy drawn from 3 items on use of independent thinking, task setting, and learning in job. Work autonomy is missing for respondents not employed. Columns (1) & (3) are z-scores, normalized to control distribution. Column (2) is first principal component. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.6: Non-cognitive skills, 2019

	Aspirations			Belief	Grit
	university or beyond	business or professional	business creation	in future	
	(1)	(2)	(3)	(4)	(5)
treatment	-0.01	0.02	0.01	0.01	0.10
	(0.02)	(0.02)	(0.01)	(0.04)	(0.04)**
N	2,624	2,624	2,624	2,624	2,624
R-squared	0.05	0.03	0.01	0.04	0.02
Control mean	0.84	0.62	0.96	0.00	0.00
Endline mean (T)	0.81	0.67	0.97	N/A	-0.01
Endline mean (C)	0.80	0.66	0.98	N/A	0.00
Baseline mean	0.73	0.60	0.77	N/A	-0.06

Sample is 2019 student tracer phone survey. Table shows regression of indicated outcome on treatment, including baseline outcome where indicated. Baseline outcome set to control mean if missing, with indicator for missing value included in regression. All regressions control for randomization strata. Belief in future uses subscale from Chinese Positive Youth Development Scale (Shek et al 2007). Regression for belief in future controls for baseline locus of control. Grit uses 4-item scale for baseline and endline, 12-item scale for 2019 tracer. Belief in future and grit reported as z-scores, standardized to control mean (except if indicated otherwise). Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.7: Economic activity, 2019

	entrepreneurship				business characteristics		employment	income		savings		borrowed
	all	own	student club	family/ peers	non-agricultural	has paid employees		total	business profit	any	amount (if >0)	for economic opportunity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
treatment	0.05	0.04	0.01	0.01	0.03	0.01	-0.04	-3.4	-6.2	0.02	-6.0	0.06
	(0.02)***	(0.02)**	(0.004)***	(0.01)	(0.01)***	(0.01)	(0.02)*	(1.4)**	(5.9)	(0.02)	(2.2)***	(0.04)
N	2,624	2,624	2,624	2,624	2,624	2,624	2,624	2,624	855	2,624	1,873	383
R-squared	0.05	0.05	0.01	0.01	0.02	0.02	0.01	0.04	0.05	0.03	0.08	0.08
Control mean	0.31	0.29	0.01	0.06	0.11	0.08	0.31	25.2	51.0	0.71	38.1	0.27
Endline mean (T)	0.33	0.28	0.04	0.05	0.09	0.07	0.14	7.4	25.2	0.64	23.1	0.49
Endline mean (C)	0.30	0.27	0.01	0.04	0.09	0.07	0.19	8.7	38.5	0.63	27.9	0.54
Baseline mean	0.22	N/A	0.00	0.09	0.04	N/A	0.13	1.6	N/A	0.31	N/A	0.23

Sample is 2019 student tracer phone survey, except borrowed (column 12), which is from in-person survey. Table shows regression of indicated outcome on treatment, including baseline outcome where indicated. Baseline outcome set to control mean if missing, with indicator for missing value included in regression. Columns (2) & (6) control for baseline business ownership. Column (9) controls for baseline business income. Column (11) controls for intervals of baseline savings. Basline outcomes not reported for columns (2), (6), (9), and (11) because they do not exactly match outcome. All regressions control for randomization strata. Income and profit refer to previous two months. Business profit (column 9) conditions on business involvement. All financial variables measured in real 2019 USD, winsorized at 99th percentile. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.8: Heterogeneous treatment effects, 2019

outcome	university enrollment			entrepreneurship			employment			income		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
treatment	0.02	0.04	0.01	0.06	0.05	0.08	-0.06	-0.03	-0.06	-2.1	-3.3	-2.8
	(0.02)	(0.01)***	(0.01)	(0.03)**	(0.02)***	(0.02)***	(0.03)*	(0.02)	(0.03)**	(2.7)	(1.4)**	(1.8)
treatment interacted with:												
female	0.03			-0.01			0.05			0.0		
	(0.02)			(0.04)			(0.04)			(3.3)		
baseline exam score		0.04			0.02			0.03			-1.5	
		(0.01)***			(0.02)			(0.02)			(1.7)	
above median SES			0.06			-0.06			0.04			-1.2
			(0.02)***			(0.04)*			(0.04)			(2.8)
N	2,624	2,527	2,624	2,624	2,527	2,624	2,624	2,527	2,624	2,624	2,527	2,624
R-squared	0.04	0.11	0.06	0.06	0.05	0.06	0.03	0.01	0.02	0.08	0.05	0.04
Control mean	0.04	0.04	0.04	0.31	0.31	0.31	0.31	0.30	0.31	25.2	25.2	25.2

Sample is 2019 student tracer phone survey. Table shows regression of indicated outcome on treatment, including baseline outcome in columns (4)-(12). Baseline outcome set to control mean if missing, with indicator for missing value included in regression. All regressions control for randomization strata and main effect of term interacted with treatment. Income measured in 2019 USD for previous two months, winsorized at 99th percentile. Baseline exam score normalized to mean zero and standard devation one. SES is first principal component of household assets, parents' education, and indicator for parents in business or professional occupation. All interaction terms measured at baseline. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

B. Populated Analysis Plan: 2021 survey

Table B.1: Baseline balance, 2021

	control	treatment	difference
	(1)	(2)	(1)-(2)
female	0.56	0.64	-0.08***
	[0.67]	[0.67]	
household assets	0.30	0.31	-0.01
	[0.22]	[0.26]	
mother completed primary school	0.58	0.62	-0.04
	[0.60]	[0.59]	
repeating S4	0.04	0.04	-0.00
	[0.21]	[0.20]	
S3 exam score (aggregate)	52.6	51.6	1.07
	[27.0]	[33.8]	
employed during school holiday	0.28	0.23	0.05*
	[0.55]	[0.55]	
understands compound interest	0.69	0.63	0.05*
	[0.52]	[0.61]	
has savings	0.37	0.33	0.04
	[0.69]	[0.64]	
can calculate business profit	0.58	0.54	0.05
	[0.68]	[0.66]	
wants to enroll in post-secondary	0.73	0.78	-0.05*
	[0.60]	[0.65]	
plans to start a business	0.78	0.77	0.01
	[0.46]	[0.50]	
grit index	2.86	3.04	-0.18***
	[1.02]	[1.22]	
Schools	104	101	
Students	765	765	

Sample is all students surveyed in 2021 tracer survey. Data from baseline survey, conducted February-March 2016. Columns (1)-(2) show means by treatment status. Standard deviation in parenthesis, clustered by school. Column (3) shows difference between (1) and (2), adjusting for stratification of treatment and clustering standard error by school. Household asset index is proportion of items owned among radio, television, telephone, refrigerator, bicycle, motorcycle, and automobile. Grit index is mean response on 1-5 scale (1=most, 5=least) to four items about passion and perseverance in pursuit of goals. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B.2: Attrition

	outcome: in sample			
	2021		2019	
	(1)	(2)	(3)	(4)
treatment	0.005	-0.148	0.010	-0.081
	(0.022)	(0.136)	(0.016)	(0.105)
treatment interacted with:				
female		-0.030		-0.002
		(0.040)		(0.029)
household assets		0.114		-0.072
		(0.138)		(0.105)
mother completed primary school		-0.008		0.007
		(0.036)		(0.028)
repeating S4		-0.071		-0.075
		(0.089)		(0.071)
S3 exam score (aggregate)		0.001		0.002
		(0.002)		(0.001)*
employed during school holiday		-0.019		-0.028
		(0.043)		(0.033)
understands compound interest		-0.015		0.009
		(0.040)		(0.027)
has savings		-0.025		0.002
		(0.042)		(0.030)
can calculate business profit		-0.032		-0.054
		(0.036)		(0.028)*
wants to enroll in post-secondary		0.075		-0.009
		(0.046)		(0.032)
plans to start a business		-0.073		0.043
		(0.045)		(0.029)
grit index		0.039		-0.001
		(0.020)*		(0.015)
N	3,095	2,983	3,095	2,983
control mean	0.49	0.50	0.84	0.84
p-value of joint test	0.82	0.43	0.52	0.40

Table reports coefficients from regression of indicator for survey response on treatment and interactions between treatment and baseline characteristics. Main effects of baseline characteristics and strata fixed effects included in all regressions. Household asset index is proportion of items owned among radio, television, telephone, refrigerator, bicycle, motorcycle, and automobile. Grit index is mean response on 1-5 scale (1=most, 5=least) to four items about passion and perseverance in pursuit of goals. Standard errors in parenthesis, clustered by school. Final row reports p-value of joint test of null hypothesis that all coefficients=0. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B.3: Calendar activity, 2019 and 2021 surveys

year	2019						2020			2021	
month	January	February	March	April	May	June	February	May	November	February	July/August
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Panel A: secondary school											
Treatment	-0.001	-0.006	-0.006	-0.007	-0.006	-0.003	-0.001	-0.003	0.002	-0.001	-0.007
	(0.011)	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)	(0.007)	(0.005)	(0.005)	(0.007)	(0.007)
Control mean	0.06	0.07	0.07	0.07	0.07	0.07	0.02	0.01	0.01	0.02	0.02
Panel B: university											
Treatment	-0.002	-0.002	0.003	0.006	0.004	0.005	0.054	0.043	0.044	0.057	0.052
	(0.002)	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.026)**	(0.018)**	(0.021)**	(0.029)**	(0.031)
Control mean	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.06	0.07	0.11	0.14
Panel C: vocational (TVET)											
Treatment	0.011	0.001	0.003	0.000	-0.007	-0.003	-0.003	-0.011	-0.008	0.004	0.009
	(0.007)	(0.010)	(0.012)	(0.012)	(0.011)	(0.010)	(0.011)	(0.009)	(0.009)	(0.009)	(0.008)
Control mean	0.03	0.06	0.08	0.08	0.09	0.07	0.06	0.04	0.03	0.03	0.02
Panel D: business											
Treatment	0.062	0.064	0.044	0.046	0.060	0.060	-0.008	0.000	0.014	0.004	0.017
	(0.017)***	(0.018)***	(0.018)**	(0.020)**	(0.019)***	(0.019)***	(0.024)	(0.023)	(0.023)	(0.023)	(0.026)
Control mean	0.23	0.30	0.35	0.38	0.38	0.33	0.32	0.31	0.30	0.31	0.35
Panel E: employed											
Treatment	-0.025	-0.032	-0.023	-0.026	-0.015	-0.031	-0.061	-0.064	-0.024	-0.043	-0.054
	(0.011)**	(0.013)**	(0.015)	(0.017)	(0.017)	(0.015)**	(0.021)***	(0.021)***	(0.021)	(0.022)**	(0.023)**
Control mean	0.12	0.17	0.20	0.24	0.24	0.21	0.23	0.22	0.23	0.28	0.33
N	2,624	2,624	2,624	2,624	2,624	2,624	1,530	1,530	1,530	1,530	1,530

Outcomes from student tracer phone survey 2019 and 2021, based on calendar recall data of enrollment by level of schooling. Data for 2019 from 2019 tracer survey. Data for 2020-2021 from 2021 tracer survey. All regressions control for female, dummy for employed, and grit as measured at baseline; and randomization strata. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.4: Academic outcomes, 2021

	completion		enrollment	
	secondary	TVET	university	TVET
	(1)	(2)	(3)	(4)
treatment	-0.011	0.001	0.030	0.006
	(0.018)	(0.012)	(0.031)	(0.009)
N	1,530	1,530	1,530	1,530
Control mean	0.89	0.07	0.15	0.03
2019 mean (T)	0.83	N/A	0.08	0.02
2019 mean (C)	0.82	N/A	0.04	0.03

Sample is 2021 student tracer survey. Table shows regression of indicated outcome on treatment. Outcome means from control group and 2019 tracer survey by treatment (T) and control (C) reported at bottom of table. All regressions control for female, dummy for employed, and grit as measured at baseline; and randomization strata. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.5: Household formation, 2021

	married	children		age at	desired	homeowner	partner	female	male
		any	number	first birth	fertility		completed secondary	empowerment index	progressive attitude
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: full sample									
treatment	0.019	0.005	0.004	-0.29	0.03	-0.03	0.007	N/A	N/A
	(0.013)	(0.021)	(0.027)	(0.28)	(0.05)	(0.02)	(0.017)		
N	1,530	1,530	1,530	289	1,530	1,530	1,530		
control mean	0.07	0.18	0.21	22.6	2.8	0.8	0.13		
Panel B: males only									
	0.007	-0.006	0.006	-1.62	-0.02	0.01	-0.009	N/A	0.004
	(0.014)	(0.020)	(0.030)	(1.35)	(0.07)	(0.04)	(0.020)		(0.023)
N	609	609	609	43	609	609	609		594
control mean	0.03	0.07	0.08	24.4	2.8	0.7	0.07		0.38
Panel C: females only									
	0.028	0.011	0.002	-0.12	0.05	-0.05	0.016	0.000	N/A
	(0.019)	(0.030)	(0.036)	(0.30)	(0.06)	(0.03)	(0.025)	(0.013)	
N	921	921	921	246	921	921	921	906	
control mean	0.11	0.27	0.31	22.2	2.7	0.8	0.18	0.65	

Sample is 2021 student tracer survey. Table shows regression of indicated outcome on treatment. All regressions control for female, dummy for employed, and grit as measured at baseline; and randomization strata. Standard errors in parentheses, clustered by school. Partner schooling conditions on being married or in a committed relationship. Female empowerment index ranges from 0-1 and defined for female sample only, as mean(HH head, makes most financial decisions by self or jointly, decides whether to work outside home by self or jointly with spouse/partner; thinks most financial decisions should be made by self or jointly; 1(desired fertility>=number of children)). Progressive household index ranges from 0-1 and defined for male sample only, as mean(financial decisions made by wife or jointly, decision to work outside home should be made by female or jointly). * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.6: Skills, 2021

	grit	belief in future	entrepreneurial spirit	monthly discount rate<100%	work skills	creativity
	(1)	(2)	(3)	(4)	(5)	(6)
treatment	0.088	0.034	-0.020	-0.004	0.038	-0.09
	(0.056)	(0.054)	(0.051)	(0.017)	(0.072)	(0.07)
N	1,530	1,530	1,530	1,530	1,530	1,530
Control mean	0.00	0.00	0.00	0.12	0.00	3.0
2019 mean (T)	0.09	0.01	0.02	0.11	0.08	2.2
2019 mean (C)	0.00	0.00	0.00	0.07	0.00	2.3
endline mean (T)	-0.01	N/A	N/A	0.15	N/A	N/A
endline mean (C)	0.00	N/A	N/A	0.14	N/A	N/A
baseline mean	-0.08	N/A	N/A	0.24	N/A	N/A

Sample is 2021 student tracer survey. Table shows regression of indicated outcome on treatment, controlling for baseline outcome where available. Outcome means from control group and previous surveys by treatment (T) and control (C) reported at bottom of table. Entrepreneurial spirit uses scale from Bruhn et al (2018). Work skills drawn from 5 items on use of technology and interaction with customers. Belief in future uses subscale from Chinese Positive Youth Development Scale (Shek et al 2007). Grit uses 4-item scale for baseline and endline, 12-item scale for 2019 and 2021 tracer. Entrepreneurial spirit, work skills, belief in future, and grit all reported as z-scores, standardized to control mean. Creativity is number of uses of pole listed. Baseline outcome included for belief in future is locus of control. All regressions control for female, dummy for employed, and grit as measured at baseline; and randomization strata. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.7: Economic activity, 2021

	entrepreneurship		business characteristics		business finances			borrowed	business	employed	wages
	all	student club	non-agricultural	has paid employees	revenue	profit	assets	for business	survived since 2019		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
treatment	0.014	0.039	0.023	0.003	-176.8	-74.3	-38.5	-0.046	0.008	-0.068	-12.2
	(0.024)	(0.015)**	(0.018)	(0.014)	(102.5)*	(35.1)**	(60.3)	(0.024)*	(0.012)	(0.026)***	(8.5)
N	1,530	1,530	1,530	1,530	466	464	465	1,530	1,530	1,530	590
Control mean	0.31	0.08	0.16	0.08	513.0	196.4	346.8	0.48	0.07	0.43	61.9
2019 mean (T)	0.35	0.02	0.14	0.08	N/A	47.7	N/A	0.30	N/A	0.27	N/A
2019 mean (C)	0.31	0.01	0.11	0.08	N/A	54.2	N/A	0.27	N/A	0.31	N/A
endline mean (T)	0.33	0.04	0.09	0.07	N/A	26.8	N/A	0.49	N/A	0.14	N/A
endline mean (C)	0.30	0.01	0.09	0.07	N/A	40.9	N/A	0.54	N/A	0.19	N/A
baseline mean	0.21	0.00	0.04	0.21	N/A	5.4	N/A	0.25	N/A	0.12	N/A

Sample is 2021 student tracer survey. Table shows regression of indicated outcome on treatment, controlling for baseline outcome where available. Outcome means from control group and previous surveys by treatment (T) and control (C) reported at bottom of table. Financial outcomes measured in USD (real terms, 2021 Q3), winsorized at 99th percentile. Business sales, profits, and assets condition on business involvement. Business sales and profits adjusted by reported frequency of business earnings to estimate profits over two months. Wages conditions on employment. All regressions control for female, dummy for employed, and grit as measured at baseline; and randomization strata. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.8: Economic security, 2021

	NEET	income last two months	assets (z-score)	any	savings amount (conditional on >0)	economic insecurity index (0-1)
	(1)	(2)	(3)	(4)	(5)	(6)
treatment	-0.003	-5.8	0.060	0.022	-2.7	-0.008
	(0.023)	(3.1)*	(0.047)	(0.023)	(8.2)	(0.007)
N	1,530	1,529	1,455	1,530	1,124	1,530
Control mean	0.23	46.9	0.00	0.72	88.4	0.23
2019 mean (T)	0.39	22.4	N/A	0.72	33.8	N/A
2019 mean (C)	0.41	26.7	N/A	0.71	40.5	N/A
endline mean (T)	0.04	7.8	N/A	0.64	24.5	N/A
endline mean (C)	0.03	9.3	N/A	0.63	29.6	N/A
baseline mean	N/A	1.8	N/A	0.35	N/A	N/A

Sample is 2021 student tracer survey. Table shows regression of indicated outcome on treatment, controlling for baseline outcome where available. Outcome means from control group and previous surveys by treatment (T) and control (C) reported at bottom of table. NEET is not in employment, education, or training. Financial outcomes measured in USD (real terms, 2021 Q3), winsorized at 99th percentile. Asset index is z-score of 1st principal component of indicators for ownership of 12 different physical assets, including livestock, vehicles, computer, and house. Economic insecurity index is proportion of 14 economic coping strategies used since start of pandemic. Savings amount regression (column 5) controls for dummies of savings reported in intervals. All regressions control for female, dummy for employed, and grit as measured at baseline; and randomization strata. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.9: Outcome trajectories, academic

sample	control		treatment		difference	
survey	tracer 2019	tracer 2021	tracer 2019	tracer 2021	tracer 2019	tracer 2021
	(1)	(2)	(3)	(4)	(1)-(3)	(2)-(4)
completed secondary	0.82	0.89	0.83	0.88	-0.003	0.010
completed TVET	N/A	0.07	N/A	0.07	N/A	0.005
enrolled in university	0.04	0.15	0.08	0.19	-0.036***	-0.039
enrolled in TVET	0.03	0.03	0.02	0.03	0.002	-0.004
Schools	104	104	103	101		
Students	1,311	765	1,313	765		

Outcomes from student tracer survey 2019/2021. Columns (1)-(4) show means by treatment status.Columns (5)-(6) show difference between treatment and control by survey wave, adjusting for stratification of treatment, variables imbalanced at baseline (female, employment, grit), and clustering standard error by school. University and TVET enrollment represent enrollment at time of survey. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B.10: Outcome trajectories, skills

sample	control				treatment				difference			
survey	baseline	endline	tracer 2019	tracer 2021	baseline	endline	tracer 2019	tracer 2021	baseline	endline	tracer 2019	tracer 2021
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(1)-(5)	(2)-(6)	(3)-(7)	(4)-(8)
grit (z)	0.00	0.00	0.00	0.00	-0.14	-0.01	0.09	0.09	0.14***	0.01	-0.09*	-0.09
	[1.37]	[1.31]	[1.07]	[1.10]	[1.47]	[1.36]	[1.16]	[1.16]				
belief in future (z)	0.00	N/A	0.00	0.00	-0.01	N/A	0.01	0.05	0.01	N/A	-0.01	-0.05
	[1.55]		[1.19]	[1.06]	[1.82]		[1.31]	[1.29]				
entrepreneurial spirit (z)	N/A	N/A	0.00	0.00	N/A	N/A	0.02	-0.05	N/A	N/A	-0.02	0.05
			[0.98]	[1.06]			[1.00]	[1.03]				
Monthly discount	0.25	0.14	0.07	0.12	0.24	0.15	0.11	0.11	0.01	-0.01	-0.04	0.01
rate<100%	[0.61]	[0.39]	[0.28]	[0.33]	[0.58]	[0.45]	[0.34]	[0.38]				
work skills (z)	N/A	N/A	0.00	0.00	N/A	N/A	0.08	0.04	N/A	N/A	-0.08	-0.04
			[1.027]	[1.51]			[1.22]	[1.72]				
uses of pole,	N/A	N/A	2.31	2.98	N/A	N/A	2.19	2.82	N/A	N/A	0.13**	0.15
number listed			[1.25]	[1.39]			[1.14]	[1.60]				
started community	N/A	0.09	0.08	0.01	N/A	0.14	0.08	0.02	N/A	-0.05***	-0.01	-0.01
project		[0.38]	[0.23]	[0.11]		[0.53]	[0.27]	[0.14]				
Schools	104	104	104	104	103	102	103	101				
Students	1,554	1,447	1,311	765	1,541	1,433	1,313	765				

Outcomes from student tracer surveys 2021/2019, endline survey 2018, and baseline survey 2016 (where available). Columns (1)-(8) show means by treatment status. Standard deviation in parenthesis, clustered by school. Columns (9)-(12) shows difference between treatment and control by survey wave, adjusting for stratification of treatment, variables imbalanced at baseline (female, employment, grit), and clustering standard error by school. Entrepreneurial spirit uses scale from Bruhn et al (2018). Work skills drawn from 5 items on use of technology and interaction with customers. Belief in future uses subscale from Chinese Positive Youth Development Scale (Shek et al 2007). Grit uses 4-item scale for baseline and endline, 12-item scale for 2019 and 2021 tracer. Entrepreneurial spirit, work skills, belief in future, and grit all reported as z-scores, standardized to control mean (except if indicated otherwise). * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B.11: Outcome trajectories, economic activity

sample	control				treatment				difference			
survey	baseline	endline	tracer 2019	tracer 2021	baseline	endline	tracer 2019	tracer 2021	baseline	endline	tracer 2019	tracer 2021
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(1)-(5)	(2)-(6)	(3)-(7)	(4)-(8)
entrepreneurship	0.25	0.30	0.31	0.31	0.19	0.33	0.35	0.31	0.06*	-0.03**	-0.04***	0.00
	[0.75]	[0.61]	[0.50]	[0.49]	[0.77]	[0.73]	[0.56]	[0.49]				
business: student	0.00	0.01	0.01	0.08	0.00	0.04	0.02	0.11	0.00	-0.03***	-0.01***	-0.03**
business club	[0.03]	[0.10	[0.07]	[0.27]	[0.03]	[0.23]	[0.13]	[0.38]				
business: non-agricultural	0.05	0.09	0.11	0.16	0.04	0.09	0.14	0.18	0.01	0.01	-0.03**	-0.02
	[0.24]	[0.36]	[0.32]	[0.38]	[0.24]	[0.31]	[0.36]	[0.37]				
business: has paid employees	N/A	0.07	0.08	0.08	N/A	0.07	0.08	0.08	N/A	0.00	0.00	0.01
		[0.26]	[0.30]	[0.31]		[0.29]	[0.23]	[0.27]				
sales, last two months	N/A	N/A	N/A	513.0	N/A	N/A	N/A	359.9	N/A	N/A	N/A	153.0*
				[1466.9]				[1242.2]				
profit, last two months	N/A	38.2	51.0	196.4	N/A	25.0	44.9	112.7	N/A	13.2**	6.2	83.7**
		[90.0]	[82.0]	[558.5]		[76.5]	[95.4]	[355.9]				
business assets	N/A	N/A	N/A	346.8	N/A	N/A	N/A	312.4	N/A	N/A	N/A	34.44
				[584.3]				[702.4]				
borrowed/attempted	0.27	0.54	0.27	0.48	0.21	0.49	0.30	0.42	0.06***	0.05	-0.03	0.06**
for economic opportunity	[0.54]	[0.60]	[0.45]	[0.52]	[0.52]	[0.64]	[0.45]	[0.52]				
business survived since 2019	N/A	N/A	N/A	0.07	N/A	N/A	N/A	0.08	N/A	N/A	N/A	-0.01
				[0.24]				[0.27]				
employed	0.15	0.19	0.31	0.43	0.11	0.14	0.27	0.34	0.03	0.05**	0.04	0.09***
	[0.61]	[0.57]	[0.45]	[0.49]	[0.66]	[0.43]	[0.55]	[0.579]				
wages last month	N/A	N/A	N/A	61.9	N/A	N/A	N/A	50.4	N/A	N/A	N/A	11.49
				[128.2]				[93.5]				
Schools	104	104	104	104	103	102	103	101				
Students	1,554	1,447	1,311	765	1,541	1,433	1,313	765				

Outcomes from student tracer surveys 2021/2019, endline survey 2018, and baseline survey 2016 (where available). Columns (1)-(8) show means by treatment status. Standard deviation in parenthesis, clustered by school. Columns (9)-(12) show difference between treatment and control by survey wave, adjusting for stratification of treatment, variables imbalanced at baseline (female, employment, grit), and clustering standard error by school. Financial outcomes measured in USD (nominal, using exchange rate at time of survey), winsorized at 99th percentile. Business sales, profits, and assets condition on business involvement. Business sales and profits adjusted by reported frequency of business earnings to estimate profits over two months. Wages conditions on employment. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B.12: Outcome trajectories, economic security

sample	control				treatment				difference			
survey	baseline	endline	tracer 2019	tracer 2021	baseline	endline	tracer 2019	tracer 2021	baseline	endline	tracer 2019	tracer 2021
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(1)-(5)	(2)-(6)	(3)-(7)	(4)-(8)
NEET	N/A	0.03	0.41	0.23	N/A	0.04	0.39	0.25	N/A	-0.01	0.01*	-0.02
		[0.19]	[0.49]	[0.46]		[0.20]	[0.59]	[0.46]				
income, last two months	1.9	8.7	25.2	46.9	1.2	7.3	21.1	37.5	0.6**	1.4	4.1*	9.4*
	[9.0]	[22.2]	[36.7]	[67.4]	[7.3]	[20.4]	[39.9]	[66.2]				
asset index(z)	N/A	N/A	N/A	0.00	N/A	N/A	N/A	0.02	N/A	N/A	N/A	-0.02
				[1.10]				[1.00]				
has savings	0.33	0.63	0.71	0.72	0.30	0.64	0.72	0.75	0.03	-0.01	-0.02	-0.02
	[0.75]	[0.62]	[0.50]	[0.44]	[0.75]	[0.69]	[0.45]	[0.48]				
savings (conditional on any)	N/A	27.6	38.1	88.4	N/A	22.9	31.9	82.9	N/A	4.7*	6.2**	5.4
		[46.8]	[53.8]	[139.0]		[34.3]	[51.5]	[147.2]				
economic insecurity index	N/A	N/A	N/A	0.23	N/A	N/A	N/A	0.21	N/A	N/A	N/A	0.02
				[0.16]				[0.15]				
Schools	104	104	104	104	103	102	103	101				
Students	1,554	1,447	1,311	765	1,541	1,433	1,313	765				

Outcomes from student tracer surveys 2021/2019, endline survey 2018, and baseline survey 2016 (where available). Columns (1)-(8) show means by treatment status. Standard deviation in parenthesis, clustered by school. Columns (9)-(12) show difference between treatment and control by survey wave, adjusting for stratification of treatment, variables imbalanced at baseline (female, employment, grit), and clustering standard error by school. NEET is not in employment, education, or training. Financial variables measured in USD (nominal, using exchange rate at time of survey), winsorized at 99th percentile. Asset index is z-score of 1st principal component of indicators for ownership of 12 different physical assets, including livestock, vehicles, computer, and house. Economic insecurity index is proportion of 14 economic coping strategies used since start of pandemic. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B.13: Heterogeneous treatment effects, 2021

outcome	university enrollment			entrepreneurship			employment			income		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
treatment	-0.02	0.02	-0.02	0.02	0.01	0.01	-0.06	-0.07	-0.05	-5.0	-5.4	-1.5
	(0.04)	(0.02)	(0.03)	(0.04)	(0.02)	(0.04)	(0.04)	(0.03)***	(0.04)	(6.0)	(3.1)*	(4.0)
treatment interacted with:												
female	0.09			-0.02			-0.01			-1.4		
	(0.05)*			(0.05)			(0.06)			(6.6)		
baseline exam score		0.03			0.02			0.05			1.8	
		(0.02)			(0.02)			(0.02)**			(2.9)	
above median SES			0.09			0.00			-0.04			-8.1
			(0.04)**			(0.05)			(0.05)			(5.8)
N	1,530	1,482	1,530	1,530	1,482	1,530	1,530	1,482	1,530	1,529	1,481	1,529
R-squared	0.08	0.25	0.10	0.04	0.05	0.04	0.06	0.07	0.06	0.11	0.11	0.11
Control mean	0.15	0.15	0.15	0.30	0.31	0.30	0.43	0.43	0.43	46.9	47.2	46.9

Sample is 2021 student tracer phone survey. Table shows regression of indicated outcome on treatment, including baseline outcome in columns (4)-(12). Baseline outcome set to control mean if missing, with indicator for missing value included in regression. All regressions control for randomization strata, main effect of term interacted with treatment, and female, dummy for employed, and grit as measured at baseline. Income measured in 2021 USD for previous two months, winsorized at 99th percentile. Baseline exam score normalized to mean zero and standard devation one. SES is first principal component of household assets, parents' education, and indicator for parents in business or professional occupation. All interaction terms measured at baseline. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

C. Additional results

Table C.1: Academic outcomes

	completion		enrollment	
	secondary	TVET	university	TVET
	(1)	(2)	(3)	(4)
Panel A: 2019				
treatment	0.002	N/A	0.031	0.000
	(0.017)		(0.009)***	(0.006)
N	2,624		2,624	2,624
Control mean	0.82		0.04	0.03
Panel B: 2021				
treatment	-0.011	-0.001	0.015	0.005
	(0.016)	(0.012)	(0.018)	(0.008)
N	1,530	1,530	1,530	1,530
Control mean	0.89	0.07	0.15	0.03

Samples are 2019/2021 student tracer surveys, as indicated. Table shows regression of indicated outcome on treatment. Outcome means from control group within each sample reported at bottom of table. All regressions control for randomization strata, with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table C.2: Transition matrix, university

	university engagement rate										
	2019					2020			2021		
previous period	February	March	April	May	June	February	May	November	February	July/August	survey
not in university	0.001	0.005	0.003	0.004	0.001	0.12	0.003	0.02	0.05	0.04	0.13
university	1.00	1.00	1.00	1.00	0.89	0.77	0.63	0.96	0.97	0.94	0.69

Table shows rate reporting "engaged in" university by month of calendar data, conditional on activity in previous period of calendar data. First period is January 2019. Data for 2019 from 2019 survey. Data for 2020-2021 from 2021 survey. Rates for February 2020 condition on activity in June 2019. Rate for 2021 survey conditions on 2019 survey, using question on university enrollment.

Table C.3: Household formation, 2021

	married	Children		age at	desired	homeowner	partner	female	male
		any	number	first birth	fertility		completed secondary	empowerment index	progressive attitude
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: full sample									
treatment	0.017	0.006	0.004	-0.30	0.01	-0.03	0.003	N/A	N/A
	(0.012)	(0.019)	(0.024)	(0.26)	(0.05)	(0.02)	(0.017)		
N	1,530	1,530	1,530	289	1,530	1,530	1,530		
control mean	0.07	0.18	0.21	22.6	2.8	0.8	0.13		
Panel B: males only									
	0.000	-0.012	-0.009	-1.64	-0.04	0.01	-0.011	N/A	-0.003
	(0.012)	(0.019)	(0.026)	(1.86)	(0.07)	(0.04)	(0.019)		(0.023)
N	609	609	609	43	609	609	609		594
control mean	0.03	0.07	0.08	24.4	2.8	0.7	0.07		0.38
Panel C: females only									
	0.026	0.026	0.027	-0.15	0.04	-0.05	0.013	-0.001	N/A
	(0.018)	(0.028)	(0.033)	(0.28)	(0.06)	(0.029)*	(0.024)	(0.013)	
N	921	921	921	246	921	921	921	906	
control mean	0.11	0.27	0.31	22.2	2.7	0.8	0.18	0.65	

Sample is 2021 student tracer survey. Table shows regression of indicated outcome on treatment. All regressions control for randomization strata, with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Standard errors in parentheses, clustered by school. Partner schooling conditions on being married or in a committed relationship. Female empowerment index ranges from 0-1 and defined for female sample only, as mean(HH head, makes most financial decisions by self or jointly, decides whether to work outside home by self or jointly with spouse/partner; thinks most financial decisions should be made by self or jointly; 1(desired fertility=number of children)). Progressive household index ranges from 0-1 and defined for male sample only, as mean(financial decisions made by wife or jointly, decision to work outside home should be made by female or jointly). * significant at 10%; ** significant at 5%; *** significant at 1%.

Table C.4: Sample response rates by number of phone calls, 2021

	control		treatment	
number of calls	respondents (1)	cumulative % (2)	respondents (3)	cumulative % (4)
1	468	30.1%	481	31.2%
2	34	32.3%	36	33.5%
3	8	32.8%	6	33.9%
4	1	32.9%	1	34.0%
missing	254	49.2%	241	49.6%
Baseline N	1,554	100.0%	1,541	100.0%

Table shows number of respondents and cumulative proportion by number of phone call attempts, 2021 survey. Missing indicates information is missing on number of call attempts. Baseline N reports number of observations in baseline survey.

Table C.5: calendar activity 2021, balanced attrition sample

year	2020			2021	
month	February	May	November	February	July/August
	(1)	(2)	(3)	(4)	(5)
Panel A: secondary school					
Treatment	-0.003	-0.003	-0.001	0.003	0.002
	(0.007)	(0.004)	(0.004)	(0.008)	(0.007)
Control mean	0.02	0.01	0.01	0.02	0.02
Panel B: university					
Treatment	0.039	0.043	0.030	0.040	0.028
	(0.018)**	(0.015)***	(0.017)*	(0.019)**	(0.021)
Control mean	0.11	0.06	0.08	0.12	0.15
Panel C: vocational (TVET)					
Treatment	0.008	-0.013	-0.011	0.008	0.016
	(0.016)	(0.011)	(0.010)	(0.011)	(0.010)
Control mean	0.06	0.04	0.03	0.03	0.02
Panel D: business					
Treatment	0.008	0.001	0.016	0.002	0.020
	(0.028)	(0.027)	(0.027)	(0.026)	(0.029)
Control mean	0.30	0.31	0.29	0.30	0.34
Panel E: employed					
Treatment	-0.069	-0.058	-0.028	-0.037	-0.053
	(0.025)***	(0.026)**	(0.025)	(0.027)	(0.028)*
Control mean	0.23	0.21	0.22	0.27	0.33
N	1,028	1,028	1,028	1,028	1,028

Outcomes from student tracer phone survey 2021, based on calendar recall data of enrollment by level of schooling. Sample balances response rates between treatment (up to two calls) and control (up to four calls), following method of Behaghel et al (2015). All regressions control for randomization strata, with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%, based on conventional p-values.

Table C.6: economic activity 2021, balanced attrition sample

	entrepreneurship		business characteristics		borrowed	business	employed	business	NEET	business
	all	student club	non-agricultural	has paid employees	for business	survived since 2019		or employment		and employment
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
treatment	-0.001	0.043	0.010	-0.003	-0.060	-0.014	-0.065	-0.044	0.000	-0.030
	(0.027)	(0.018)**	(0.022)	(0.016)	(0.028)**	(0.014)	(0.029)**	(0.029)	(0.026)	(0.015)**
N	1,028	1,028	1,028	1,028	1,028	1,028	1,028	1,028	1,028	1,028
Control mean	0.30	0.07	0.16	0.07	0.47	0.07	0.44	0.66	0.23	0.08
endline mean (T)	0.29	0.03	0.08	0.07	0.49	NA	0.14	0.40	0.03	0.03
endline mean (C)	0.29	0.01	0.09	0.05	0.55	NA	0.18	0.43	0.02	0.03
baseline mean	0.22	0.00	0.04	0.22	0.25	NA	0.12	0.24	NA	0.09

Sample is 2021 student tracer survey, with balanced response rates between treatment (up to two calls) and control (up to four calls), following method of Behaghel et al (2015). Table shows regression of indicated outcome on treatment, controlling for baseline outcome where available. Outcome means from control group within sample reported at bottom of each panel. "Borrowed for business" includes attempts to borrow. NEET refers to not in employment, education, or training. All regressions control for randomization strata, with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Endline means for treatment (T) and control (C) and overall baseline mean reported at bottom of table. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%, based on conventional p-values.

Table C.7: income and economic security 2021, balanced attrition sample

source	profit			wages		savings		total income	assets (z)	economic insecurity (0-1)
conditional?	no	yes	yes (alt.)	no	yes	no	yes	no	no	no
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
treatment	-19.9	-65.8	2.4	-10.9	-14.6	0.1	-2.2	-4.7	0.008	-0.012
	(13.8)	(45.0)	(14.1)	(4.7)**	(10.6)	(7.2)	(9.6)	(3.5)	(0.054)	(0.008)
N	1,028	306	306	1,028	407	1,028	746	1,027	974	1,028
Control mean	2.8	178.1	73.9	27.7	62.9	62.8	87.5	46.1	0.01	0.23
endline mean (T)	8.1	31.7	31.7	N/A	N/A	16.3	24.4	7.2	N/A	N/A
endline mean (C)	7.8	31.7	31.7	N/A	N/A	18.5	29.4	9.1	N/A	N/A
baseline mean	2.4	4.2	4.2	N/A	N/A	-99.0	N/A	1.9	N/A	N/A

Sample is 2021 student tracer survey, with balanced response rates between treatment (up to two calls) and control (up to four calls), following method of Behaghel et al (2015). Table shows regression of indicated outcome on treatment, controlling for baseline outcome where available. Outcome means from control group within sample reported at bottom of each panel. Financial outcomes measured in USD (real terms, 2021 Q3), winsorized at 99th percentile. “Conditional" refers to participation in indicated activity, e.g., profits conditional on entrepreneurship, wages conditional on employment, savings conditional on any savings. If “conditional" is no, then outcome is unconditional distribution, with zero imputed for respondents not involved in respective activity. Business sales and profits adjusted by reported frequency of business earnings to estimate profits over two months. Alternative profit measure uses alternative adjustment for reported frequency based on coding error in 2021 survey. Wages adjusted by reported frequency to estimate monthly wage. Asset index is z-score of 1st principal component of indicators for ownership of 12 different physical assets, including livestock, vehicles, computer, and house. Economic insecurity index is proportion of 14 economic coping strategies used since start of pandemic. Savings regressions (columns 6-7) control for dummies of savings reported in intervals. All regressions control for randomization strata, with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Endline means for treatment (T) and control (C) and overall baseline mean reported at bottom of table. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table C.8: Heterogeneous treatment effects by COVID-19 prevalence

outcome	University		business		employment		income		profit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: 2019										
treatment	0.04	0.03	0.07	0.07	0.02	-0.01	-6.1	-3.7	-45.8	-21.6
	(0.03)	(0.01)**	(0.05)	(0.03)**	(0.04)	(0.03)	(3.8)	(2.2)*	(18.0)**	(10.2)**
treatment interacted with:										
cases (per thousand)	-0.002		-0.001		-0.01		0.7		6.9	
	(0.004)		(0.008)		(0.01)		(0.6)		(2.9)**	
deaths (per thousand)		-0.071		-0.21		-0.41		46.0		403.0
		(0.289)		(0.66)		(0.60)		(47.5)		(181.3)**
N	2,624	2,624	2,624	2,624	2,624	2,624	2,624	2,624	855	855
Mean outcome (control)	0.04	0.04	0.31	0.31	0.31	0.31	26.7	26.7	54.2	54.2
Mean cases/thousand	5.5	0.03	5.5	0.03	5.5	0.03	5.5	0.03	5.6	0.04
Panel B: 2021										
treatment	0.03	0.02	0.03	0.02	-0.04	-0.07	-15.6	-11.2	10.7	-50.1
	(0.05)	(0.03)	(0.06)	(0.03)	(0.07)	(0.04)*	(8.6)*	(5.0)**	(82.8)	(50.9)
treatment interacted with:										
cases (per thousand)	-0.003		-0.003		-0.01		1.8		-20.8	
	(0.007)		(0.011)		(0.01)		(1.4)		(15.6)	
deaths (per thousand)		-0.239		-0.22		0.25		165.0		-849.2
		(0.572)		(0.87)		(0.92)		(124.6)		(1444.1)
N	1,530	1,530	1,530	1,530	1,530	1,530	1,529	1,529	464	464
Mean outcome (control)	0.15	0.15	0.30	0.30	0.43	0.43	46.9	46.9	196.4	196.4
Mean cases/thousand	5.4	0.03	5.4	0.03	5.4	0.03	5.4	0.03	5.5	0.03

Samples are 2019 and 2021 student tracer surveys, as indicated. Table shows regression of indicated outcome on treatment and interaction with district-level COVID-19 prevalence. Observations assigned to district of their baseline secondary school. COVID-19 prevalence measured in cases or deaths from January 2020-July 2021 per thousand population from 2012 Census. All regressions control for randomization strata, main effect of term interacted with treatment, and baseline outcome where available (columns (3)-(10)), with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Baseline outcome set to control mean if missing, with indicator for missing value included in regression. Income and profits measured in 2021 USD for previous two months, winsorized at 99th percentile. Profits adjusted by reported frequency to estimate profits over two months. Alternative profit measure uses alternative adjustment for reported frequency based on coding error in 2021 survey. Means of control group outcome and level of COVID-19 prevalence within sample reported at bottom of each panel. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table C.9: Selection into entrepreneurship, excluding university students

	business participation			income			profit		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: 2019									
Treatment	0.09	0.09	0.07	-3.1	-1.9	-2.0	-9.9	-8.2	-4.1
	(0.02)***	(0.02)***	(0.02)***	(1.9)	(2.0)	(1.6)	(11.8)	(13.4)	(7.7)
treatment*high Pr(entrepreneur)	-0.04	-0.05		1.8	-0.6		2.3	-0.7	
	(0.04)	(0.04)		(3.1)	(3.1)		(14.2)	(15.5)	
treatment*business at baseline			0.01			-0.4			-13.6
			(0.04)			(3.9)			(13.5)
N	2,473	2,473	2,473	2,473	2,473	2,473	827	827	827
treatment + interaction	0.05	0.04	0.08	-1.3	-2.5	-2.4	-7.6	-8.9	-17.6
p(treatment + interaction)	0.08	0.10	0.05	0.57	0.27	0.50	0.30	0.21	0.10
Control mean	0.32	0.32	0.32	26.9	26.9	26.9	54.5	54.5	54.5
Panel B: 2021									
Treatment	0.01	0.08	0.00	-3.7	-4.0	-4.1	-55.0	-143.3	-55.3
	(0.03)	(0.04)**	(0.03)	(3.6)	(4.2)	(3.5)	(34.3)	(57.8)**	(32.0)*
treatment*high Pr(entrepreneur)	0.11	-0.10		5.1	2.2		-61.4	99.2	
	(0.07)*	(0.05)**		(7.7)	(6.1)		(76.3)	(68.3)	
treatment*business at baseline			0.12			8.5			-71.0
			(0.07)*			(8.3)			(83.9)
N	1,272	1,272	1,272	1,271	1,271	1,271	420	420	420
treatment + interaction	0.11	-0.03	0.13	1.5	-1.7	4.4	-116.4	-44.1	-126.2
p(treatment + interaction)	0.06	0.51	0.04	0.83	0.71	0.56	0.09	0.28	0.11
Control mean	0.32	0.32	0.32	47.6	47.6	47.6	200.2	200.2	200.2
Pr(entrepreneurship) by CV lasso (L) or ridge (R)	L	R	NA	L	R	NA	L	R	NA

Samples are 2019 and 2021 student tracer surveys, as indicated. Sample excludes students enrolled in university at time of survey. Income and profit measured in USD (real terms, 2021 Q3) from last two months, winsorized at 99th percentile. High Pr(entrepreneur) is indicator for above median probability of contemporaneous entrepreneurship calculated by cross-validated lasso or ridge regression model (10 folds) using control group sample. Additional candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes and squared terms of continuous measures. Outcome mean from control group within sample reported at bottom of each panel. All regressions control for main effect of interaction term, randomization strata, and baseline outcome. Additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Control group mean imputed for baseline outcomes with missing data, with dummy for missing included in regression. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table C.10: Heterogeneous treatment effects (pre-specified)

outcome	university enrollment			entrepreneurship			employment			income		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: 2019												
treatment	0.02	0.04	0.01	0.06	0.06	0.09	-0.05	-0.02	-0.04	-1.9	-2.3	-1.4
	(0.01)*	(0.01)***	(0.01)	(0.03)*	(0.02)***	(0.02)***	(0.03)*	(0.02)	(0.02)*	(2.8)	(1.4)	(1.8)
treatment interacted with:												
female	0.01			-0.01			0.05			-0.4		
	(0.02)			(0.04)			(0.04)			(3.5)		
baseline exam score		0.04			0.02			0.02			-2.5	
		(0.01)***			(0.02)			(0.02)			(1.8)	
above median SES			0.05			-0.06			0.05			-1.3
			(0.02)***			(0.03)*			(0.04)			(2.9)
N	2,624	2,624	2,624	2,624	2,624	2,624	2,624	2,624	2,624	2,624	2,624	2,624
Control mean	0.04	0.04	0.04	0.31	0.31	0.31	0.31	0.31	0.31	26.7	26.7	26.7
Panel B: 2021												
treatment	0.01	0.02	-0.01	0.02	0.02	0.01	-0.06	-0.06	-0.05	-5.6	-5.3	-1.3
	(0.03)	(0.02)	(0.02)	(0.04)	(0.02)	(0.03)	(0.04)	(0.02)**	(0.04)	(6.1)	(3.1)*	(4.0)
treatment interacted with:												
female	0.01			-0.02			-0.01			-0.3		
	(0.03)			(0.05)			(0.06)			(6.6)		
baseline exam score		0.01			0.01			0.04			1.6	
		(0.02)			(0.02)			(0.02)			(2.8)	
above median SES			0.06			0.00			-0.04			-7.7
			(0.03)*			(0.05)			(0.05)			(5.6)
N	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,529	1,529	1,529
Control mean	0.15	0.15	0.15	0.30	0.30	0.30	0.43	0.43	0.43	46.9	46.9	46.9

Samples are 2019 and 2021 student tracer surveys, as indicated. Table shows regression of indicated outcome on treatment and interaction with baseline characteristics. All regressions control for randomization strata, main effect of term interacted with treatment, and baseline outcome where available (columns (4)-(12)), with additional baseline covariates chosen using post-double selection lasso. Candidate covariates include all baseline characteristics specified in analysis plan balance test and outcomes, including squared terms of continuous measures and all two-way interactions. Baseline outcome set to control mean if missing, with indicator for missing value included in regression. Income measured in 2021 USD for previous two months, winsorized at 99th percentile. Baseline exam score normalized to mean zero and standard deviation one. SES is first principal component of household assets, parents' education, and indicator for parents in business or professional occupation. All interaction terms measured at baseline. Outcome means from control group within sample reported at bottom of each panel. Standard errors in parentheses, clustered by school. * significant at 10%; ** significant at 5%; *** significant at 1%.