Financial Constraints and Girls Post-Primary Education: Evidence from a School Fee Elimination Program in Gambia*

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March 12, 2015

Abstract

We assess the impact of a large-scale tuition waiver program for girls on the quantity, composition, and achievement of students. The gradual rollout of the program across geographic regions provides identifying variation in the policy. The program increased both access to secondary education and learning outcomes. We find increases in the number of girls and boys taking the high school exit exam, as well as increases in the share of students enrolling in private school. Combined scores for math and English increased by about 0.1 standard deviations for girls and boys in response to the program. These findings together suggest that financial constraints remain serious barriers to post-primary education and that efforts to expand access to secondary education can also improve learning outcomes.

JEL Classification: O15, I21, C93.

*The authors would like to thank the Gambia office of the West African Examinations Council for providing test score data and the Gambian Ministry of Basic and Secondary Education for providing details on the program. We thank Kehinde Ajayi and Paul Thompson for helpful comments. We also thank Andrew Spaeth for research assistance. The authors assume full responsibility for any errors.

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1 Introduction

Most countries in Sub-Saharan Africa have experienced large expansions of access to primary education over the past two decades. For example, the number of primary school children has doubled between 1998 and 2009 in countries like Burkina Faso, Madagascar, Mali, and Mozambique.[1] Despite such success at the primary level, net secondary enrollment remains low in the least developed countries, at 35% for boys and 29% for girls between 2008-2011.[2] Large gender enrollment gaps in many Sub-Saharan African countries pose additional challenges for girls seeking to pursue their education beyond the primary grades. One potential explanation for the low and stagnating secondary enrollment figures may be financial constraints. Relative to primary school, the overall cost of attending secondary school is much larger due to higher tuition fees, higher opportunity costs as children are older and may earn more on the labor market, and transport costs associated with fewer secondary school choices, especially in rural areas. To date, only a handful of countries in the region, such as South Africa, Ghana, and The Gambia, offer large scale tuition-free secondary education or some form of financial aid through various scholarship programs.

The Gambia has been a pioneer in promoting access to secondary education, offering fee-free public schooling for girls in grades 7-12 on a nearly national scale for more than a decade. In this paper, we evaluate this policy, known as the girls' scholarship program, on students' progress and learning outcomes. Two features of the policy make it especially suited for rigorous evaluation. First, the program was rolled out to different regions on a staggered schedule between 2001-2004. This allows us to use the regions that received the program later as a control group, exploiting variation in program receipt over time and across regions. Second, the program exclusively targeted girls, allowing us to measure differential effects between boys and girls within the same regions. To our knowledge, this is the first paper to evaluate the impact of a large-scale tuition waiver program at the secondary school

[1] Source: EdStats, World Bank.

[2] Source: UNESCO Institute for Statistics (UIS), based on selected countries where data is available.

level in Africa.[3]

We find that the program had important effects on both access and student achievement. The policy substantially increased the number of high school exit exam test takers in both public and private schools.[4] The average age of test-takers also increased, suggesting that the policy helped keep students in schools or induced some students whose studies were interrupted to return. In terms of learning outcomes, we find an average effect of 0.19 standard deviations for girls and 0.15 standard deviations for boys on the standardized English test score. The combined effect on both Math and English is about 0.1 standard deviations for both boys and girls. In recent years, The Gambian government has engaged several initiatives toward improving learning outcomes (Blimpo *et al.*, 2011; Pugatch & Schroeder, 2014). However, the findings from this study suggest that those efforts need not come at the expense of expanding access.

As mentioned previously, the study occurs against a backdrop of sustained attention among both policymakers and researchers to primary education, with relatively less emphasis on the secondary level. Expanded access to primary education resulted from concerted policies, both internationally and nationally, aimed at removing financial constraints through school fee elimination and other measures. Enrollments in primary schools have accelerated in many countries since the 1990 Jomtien conference where over 150 countries adopted the Education For All initiative. This commitment was renewed during the Dakar Framework for Action in 2000 where among other things, tuition removals as well as the removal of other cost barriers were targeted. Over the past two decades, more than twenty African countries have waived tuition from primary education and many more have some form of targeted programs to ease access to the most disadvantaged populations. Several recent comprehensive literature reviews concluded that the great majority of interventions that reduced

[3]Blimpo (2014) evaluated the effect of financial incentives on secondary school children in Benin and found large gains on test scores. This policy, however, did not target access directly and provided no additional resources upfront.

[4]Related work by one of this study's authors also found a large enrollment effect of the policy for the relevant age group using household survey data (Gajigo, 2012).

tuition fees and other costs increased enrollment, suggesting that financial constraints are among the most important barriers to access to primary education (Petrosino *et al.*, 2012; Krishnaratne *et al.*, 2013; Murnane & Ganimian, 2014).

These great successes on access have been achieved amid recent but growing concerns about the quality of education and potential degradation of learning outcomes (Pritchett, 2013). More recent research has focused on the impact of some these access-oriented policies not only on enrollment but also on learning outcomes. For example, Kazianga *et al.* (2013) found that a comprehensive program that included school construction and student attendance incentives increased substantially both enrollment and test scores of primary school students in Burkina Faso. A similar, but experimental study, which brought community schools to Afghan villagers found equally large effect on both enrollment and test scores (Burde & Linden, 2013). In Kenya, Lucas & Mbiti (2012a) found that elimination of primary school fees led to substantial gains on enrollments with very little negative effect on the test score of those who would have attended in the absence of the tuition waiver. These studies suggest that at least at the primary school level, the tradeoff between expanding access and learning outcomes might be less pronounced than one might think.

Given these successes in improving access and (to a lesser extent) learning in primary education, for many countries the logical next step is to improve access and outcomes in secondary education. Fewer policies and studies have focused on secondary education, however. Early results from an ongoing study on a scholarship program in Ghana found large enrollment effects among scholarship winners relative to the control group three years after the program started (Duflo *et al.*, 2009). They concluded that financial barriers might be crucial at the secondary level as well. Outside of Africa, Muralidharan & Prakash (2013) evaluated a program that substantially reduced girls' cost of attending secondary school through provision of bicycles, increasing enrollment by 30% and cutting the gender gap by 40%. Yet major gaps in understanding remain, particularly with regard to student achievement. A review of the post-primary schooling literature by Banerjee *et al.* (2013) concluded, "Despite the overarching positive results of price-based policies in increasing school enrollment and attendance, the evidence on the effects of price reductions on student performance is less conclusive" (p. 21).

We contribute to that literature by being the first to evaluate a large-scale tuition elimination policy for secondary education in Africa, as previously mentioned. We use administrative data on the universe of standardized test scores in The Gambia from 1998-2012; we are the first researchers to obtain and analyze this data. We also contribute to the broader literature on efforts to close the gender gap in access and learning. Several other studies have evaluated similar programs targeting girls (Kim *et al.* 1999a, Kim *et al.* 1999b, and Chaudhury & Parajuli 2010 for Pakistan; Filmer & Schady 2008 for Cambodia; Kremer *et al.* 2009 for Kenya; Baird *et al.* 2011 for Malawi; Begum *et al.* 2012 for Bangladesh; and the previously mentioned Kazianga *et al.* 2013 and Muralidharan & Prakash 2013 for Burkina Faso and India, respectively), with a consensus finding that reducing the cost of attendance leads to gains in enrollment. Of these, however, only Baird *et al.* (2011) examines learning outcomes among secondary school students as we do, using a program that is more local in scope than our setting.

In the next section, we describe the education system in The Gambia and the girls' scholarship program. Sections 3-4 present the methodology and data we use for analysis. Section 5 presents results, and Section 6 concludes.

2 Contextual Background

In the Gambian education system, the first 9 years are formally known as the Basic Cycle. This includes 6 years of primary school (grades 1-6) and 3 years of Upper Basic School (middle school, grades 7-9). High school, known locally as Senior Secondary School, consists of grades 10-12. The West African Senior School Certificate Examination (WASSCE, hereafter the Grade 12 exam), instituted in 1998, is administered at the end of grade 12, and is required for advancing to the tertiary level (i.e., university). The exam is administered by the West African Examination Council (WAEC), a regional institution that conducts examinations in the 4 former British colonies in West Africa (Gambia, Ghana, Nigeria and Sierra Leone).[5]

WAEC generates exam questions each year in consultations with the Ministry of Education, based on existing curricula. Accordingly, the exam measures achievement in specific subjects, rather than innate ability. Students choose a minimum of 6 and a maximum of 9 subjects, but the core and mandatory subjects are Mathematics and English, which will be our focus. There is no fixed passing mark for the exam. Because the exam is based on curricula designed by the Ministry of Education, and these have not undergone any major change, the exam questions should be comparable over time.

There is a structured system in the way the exam is conducted. Each year, sealed questions are delivered at the test centers the day before the scheduled exam.[6] On the day of the exam, teachers from other schools serve as invigilators (proctors). The exams are centrally graded by WAEC. This structure is similar to the way national exams are conducted in other countries (Kremer *et al.*, 2009).

Like other African countries, The Gambia charges fees for public school attendance. The Gambia levies fees beginning in grade 7, as primary education is nominally free for public schools. Students are still responsible for purchasing textbooks, uniforms and other materials, leading students to bear costs even at the primary school level.

The scholarship program for female middle and high school students started as an initiative funded jointly by UNICEF, the World Bank, and the International Monetary Fund through the Highly Indebted Poor Countries program and the Gambian government. The goal of the program is to increase overall student enrollment but with a specific focus on reducing the gender gap in education. The program pays mandatory school fees for all girls

[5]Students also take an exam at the end of grade 9, also administered by WAEC, as a requirement for matriculation into high school. Because this exam was introduced in 2003, there is only one pre-treatment region-year available in the data. We therefore focus on the Grade 12 exam in this paper.

[6]Schools serve as test centers. In almost all cases, students take the exams at the school they attend.

in grades 7-12 in the regions in which it is implemented.[7] The only criteria for benefitting from the program are gender (female) and attending a public middle or high school.[8]

The scholarship program was introduced in 2001 for Regions 5 and 6 only.[9] The program was extended to Regions 3 and 4 in the following year. Two academic years later, the program was further scaled to include Region 2 in 2004. The scholarship program has not been extended to Region 1, which is the most urbanized region, and relatively more developed. Figure 1 provides a map of Gambia's regions, while Figure 2 shows the rollout of the program over time.

To implement the program, a specially-designated Ministry of Education administrator handles the disbursement of funds between the program and schools. The regional offices of the Ministry verify the enrollment figures provided by individual schools before the scholarship funds are transferred. Therefore, at no point do the beneficiary households handle the money, thereby removing any chance of the scholarship funds being diverted for other purposes. The average cost of the program per student was US$48, US$43, US$42 and US$43 in 2001, 2002, 2003 and 2004, respectively Gambia Ministry of Basic and Secondary Education (2004).[10] The program was widely publicized through local media, as well as through several workshops in various regions of the country.

This program was the only large-scale policy aimed at increasing secondary school access in the country during our sample period. Other national policies focused on primary education, and no other policy coincided with the scholarship program in geographic scope and timing. Nonetheless, a supplementary scholarship program targeting a subset of secondary

[7]The major sub-national units in The Gambia are 6 regions. Below these sub-national units, there are 43 districts as of 2013.

[8]For purposes of this paper, public schools refer to both government and grant-aided schools, the latter of which are publicly funded but administered privately. Both types of public schools are eligible for the scholarship program, while private schools are not.

[9]We follow the Gambian convention in referring to the 2000-2001 academic year as 2001, to 2001-2002 as 2002, and so on.

[10]The average value changed over time because of changes in the exchange rate (the average value of a US dollar per Gambian Dalasi was approximately 13, 15, 20, 27 between 2000 and 2003) and also changes in the composition of students covered (middle and high school students) over time as the program got scaled.

schools in Region 2 was implemented during the sample period,[11] as was a program offering a salary premium to primary school teachers in all rural areas excluding Region 2 (Pugatch & Schroeder, 2014). We therefore checked the robustness of all analysis to the omission of Region 2 and found qualitatively similar results (omitted for brevity but available upon request). We have little remaining concern about confounding factors that may threaten the identification of the impact of this particular program.

3 Methodology

This paper analyzes the effect of the Gambian girls' scholarship program on student learning using administrative data on standardized test scores. The staggered rollout of the program across regions provides an opportunity to compare outcomes in regions that received the program early with those that received it late. Additionally, the targeting of the program to girls allows for comparisons between male and female students within a region after receipt of the program.

Following the difference-in-differences strategy of Gajigo (2012), we estimate the following regression separately for boys and girls:

$$y_{icrt} = \beta D_{rt} + X_{icrt}\gamma + \delta_c + \theta_t + \epsilon_{icrt} \tag{1}$$

where y_{icrt} is the outcome (i.e., test score) of student i at test center c in region r in year t; D_{rt} is a dummy for whether the scholarship program was implemented in region r at time t; X is a vector of individual characteristics, including a constant; and δ and θ are test center and time fixed effects, respectively. The coefficient β is the difference-in-differences estimate of the effect of the program because it compares changes in test performance of students in regions that received the program to changes in regions that did not. The identifying assumption is

[11] The Ambassador Girls Scholarship Program, led by USAID, targeted both girls and boys in selected secondary schools in Region 2. It went beyond the program studied in this paper by covering school fees, books, uniforms, and school supplies. However, its oldest recipients entered 12th grade in 2012, the last year of our data, meaning that the two scholarship programs overlap for only one region-year in our sample.

that in the absence of the program, changes in outcomes in regions that received the program early would have been the same as in regions that received the program late. We examine the validity of this assumption by testing for common pre-treatment trends across regions.

Equation (1) establishes the region as the unit of treatment and estimates the average effect of the program on male and female students separately. Because the program eliminated fees for girls only, however, we can also explore differential changes in performance between male and female students by pooling the sample and modifying the specification to:

$$y_{icrt} = \phi female_{icrt} + \beta D_{rt} + \rho D_{rt} * female_{icrt} + X_{icrt}\gamma + \delta_c + \theta_t + \epsilon_{icrt} \tag{2}$$

where $female$ is a dummy variable and all other notation is as before. In this triple-difference specification, the coefficient ρ captures any differences in program impact between male and female students.

Additionally, we can use variation in the length of program exposure among students to estimate the marginal effect of program duration on learning. For instance, students in 2004 will have had one year of program exposure if they attended school in Region 2, but 3 years of exposure in Regions 3-4 and 4 years in Regions 5-6. Within regions, students in different cohorts will also vary in their exposure. Region 6 students in 12th grade in 2001 will have one year of program exposure, while 11th graders will have two years of exposure when they take the exam the following year. Regressions that use variation in length of exposure to the program will take the form:

$$y_{icrt} = \beta yrsexposed_{rt} + X_{icrt}\gamma + \delta_c + \theta_t + \epsilon_{icrt} \tag{3}$$

where $yrsexposed$ measures the duration of a student's exposure to the scholarship program based on the date of program rollout by region combined with the test date. $yrsexposed$ ranges from zero, for students not exposed to the scholarship in their region, to 6, for students whose region received the scholarship since they attended grade 7.

In other words, we modify the main difference-in-difference specification (1) to allow the treatment effect to vary according to length of a student's exposure. Similarly, replacing the treatment indicator D with $yrsexposed$ in the triple-difference specification (2) estimates whether the effect of program exposure varies between boys and girls.

We cluster all standard errors by test center, of which there are 32.

4 Data

Outcome data are the universe of student-level test score records of the West African Examinations Council (WAEC). Subject-level scores are available for each student for 1998-2012, allowing for several years of pre-treatment outcomes for each region.[12] We omit Region 1 (Banjul, the capital) from all analysis because of its dissimilarity with the rest of the country. We also omit private schools because they were ineligible for the scholarship program. However, all raw test results are converted to z-scores based on the universe of results in a given year, including students from private schools and Region 1. This allows us to interpret scores relative to the national norm. It also explains why mean z-scores tend to be negative in our estimation sample.

Omitting private schools drops 25% of test-takers. This high percentage could bias results if students sort non-randomly into public and private high schools in response to the scholarship. In 2004, when program rollout was complete, only 2 of 35 districts had both a public and private high school (grades 10-12). By 2012, the last year for which we have data, this figure had grown to 9. We will therefore assess whether the growth in private school enrollment was related to the scholarship program.

However, all of these private schools are located in the urban districts of Region 2, near the capital, as shown in Figure A1.[13] Students in most areas are therefore constrained

[12]We omit data from 2004 because student gender is missing for that year.

[13]The map shows schools in 2011, the most recent year for which location data are available. Region 1 schools are excluded from the estimation sample but shown on the map for illustration. Not all schools in the sample appear on the map due to missing location data.

to attend their local public school. As mentioned above, our analysis changes little when excluding Region 2 from the sample, suggesting that competition from private schools does not influence our results.

We also use data from the 1998 wave of the Integrated Household Survey (IHS) to explore heterogeneity in results by district characteristics. This survey, which is conducted by the Gambia Bureau of Statistics, is nationally representative and collects information on assets, demographic and socioeconomic information. In the 1998 survey, slightly over 1,900 households were covered including approximately 4,500 school-aged children.

The Gambia made considerable strides in reducing the gender enrollment gap since implementing the scholarship program.[14] Figure 3 shows Ministry of Education data on the female enrollment percentage over time for each grade. Two key facts are apparent from the figure. First, the female enrollment percentage increased over time for all grades. Second, females comprise a lower share of enrollment as grade level increases (with only a few exceptions). Females will therefore be under-represented among test-takers relative to their enrollment shares in their corresponding schools.[15]

Test-taking patterns follow these enrollment trends. Table 1 presents summary statistics separately for boys and girls. The number of test-takers is relatively small in 1998, particularly for girls; the 210 girls taking the test that year represent only 22% of the total. By 2005, when all regions had the girls' scholarship program for at least two years, the number of students taking the exam nearly doubled and the female share rose to 35%. These upward trends continued through 2012, the last year of available data. For both boys and girls, performance improved in English over this time, but stagnated or fell in math. Overall, performance improved for both boys and girls in the sample period. Figure A2 shows the full time series of scores by region-group, separately by subject and gender. The paths of scores are noisy, underscoring the need for a regression framework to control for school-, time-, and

[14] All data presented in this and subsequent analysis are for public schools only, unless stated otherwise.

[15] The enrollment data do not track individual students over time, making it impossible for us to construct grade progression rates without making additional assumptions.

student-level effects.

5 Results

5.1 Pre-treatment outcome trends

Before presenting estimates of the program's impact, we first check the validity of our identifying assumption of common outcome trends between regions that received the program early and those that received it late. To do so, we rescale time so that $t = 0$ corresponds to the year of treatment receipt in each region and limit the sample to pre-treatment periods only. We then regress outcomes on a time trend and its interaction with indicators for regions 5 and 6 (which received the program first, in 2001) and regions 3 and 4 (which received the program in 2002). Statistically significant coefficients on these interaction terms would indicate differential pre-treatment trends among regions, calling into question the identifying assumption of our difference-in-differences strategy.

Table 2, column (1) shows results for the count of girls taking the exam, by test center. The coefficients on the time trend-region interactions are not significant, either separately or jointly (the final row of the table presents the p-value of the joint hypothesis test). The analogous regression for boys in column (5) also provides no evidence of differential trends. The remaining columns of the table present results for test scores at the student level, separately for English and math as well as the combined English and math score. These regressions also include the student's age (measured continuously, based on date of birth) and age squared. Again, there is no evidence of differential pre-treatment trends by region.[16]

[16] In the pre-treatment period there are only 11 test centers, which will likely lead our test center-clustered standard errors to overstate the precision of our estimates. However, this bias would lead us to over-reject the null of no differential trends, whereas we fail to reject the null in all specifications.

5.2 Enrollment and sorting in response to scholarship

The scholarship program could affect learning outcomes by altering the quantity of students taking exams, the composition of students, or the learning resources available to them. We examine each of these channels before presenting the main results.

In Table 3, we present estimates of the effect of the girls' scholarship program on the number of test-takers and the proportion from private schools. Here, we aggregate the data by district, as this is the relevant level for any public-private competition.[17] In column (1), the coefficient on program receipt indicates that 26.1 additional girls per district took the exam in regions that received the program early relative to those that did not, significant at 5%. In column (2) we include an interaction between program receipt and "high enrollment gap," which is an indicator for whether the test center's district was below the median enrollment rate for secondary school-aged children (ages 13-18) in 1998.[18] Areas with a high enrollment gap have the highest potential influx of students from introduction of the scholarship. The coefficient on this interaction term is positive as expected, but not statistically different from zero.

Columns (3)-(4) of Table 3 repeat the exercise with the share of female test-takers in private schools as the outcome. The scholarship led to a 21.1 percentage point increase in this share, significant at 10%. However, the interaction term in column (4) reverses this effect in high enrollment gap districts. In fact, these districts saw a reduction in the private school share of 8 percentage points. The results are consistent with flight to private schools due to space limitations or perceived lower quality of public schools in response to the scholarship. In high enrollment gap districts, however, students are more likely to lack the means or opportunity to exit to private schools.

Columns (5)-(8) examine the same outcomes for boys, with largely similar results. In-

[17] There was only one private test center-year in the pre-treatment period, making it impossible to identify the program effect separately from test center dummies among the sample of private test centers.

[18] The strategy resembles that of Lucas & Mbiti (2012a,b), which study the effect of free primary schooling in Kenya.

creases in the number of boys taking the exam are somewhat surprising, given that the program targeted girls. Yet since boys constitute the majority enrolled in the high school grades (see Figure 3), they are therefore likely to be more prevalent at the test-taking margin, making possible relatively large spillover effects of the program.[19] Columns (9)-(10) find no significant effects of the program on the proportion of test-takers who are female, though the coefficients are positive. Overall the program appears to have increased the number of students taking the exam and to have hastened the growth of private schools.

Given these increases in the number of test-takers and their shift to private schools, we are also interested in whether the characteristics of test takers changed. Table A1 compares test takers in public and private schools.[20] Compared to private school students, students in public schools earn higher scores, particularly in English (0.16 standard deviations for girls and 0.22 for boys). Although we cannot determine whether these patterns reflect pre-existing differences between these students or higher quality of instruction in public schools, public school students are also younger and (for boys) less likely to be absent from the exam,[21] suggesting that weaker students sort into private schools.

Table A2 explores whether the scholarship program changed the composition of test takers within public schools. Although the characteristics available for study in the data are limited, we can check if test takers are older or more likely to be absent in response to the scholarship, either of which would be evidence of negative selection. In columns (1) and (5), we find that students in scholarship areas are older, though the difference is significant only for boys. The interaction between the program and the high enrollment gap indicator is also positive, with boys in these areas a half year older than pre-treatment test takers in

[19]Other programs that targeted girls for reduced schooling costs have also shown increases in male enrollment (Kim *et al.*, 1999a; Begum *et al.*, 2012), which the authors explain as a spillover to male siblings. Our data do not allow us to distinguish siblings among test takers or enrolled in other grades, however.

[20]Due to the lack of pre-treatment observations for private schools (just one private test center-year in the pre-treatment period), we cannot use the regression specification in (1) to compare public and private school students. Instead, Table A1 limits the sample to post-treatment observations and checks for differences in means.

[21]Here, absence refers to students who registered for the exam but do not have a score on either the math or English subject test, both of which are required. Including enrolled students in Grade 12 who did not register for the exam could make these rates even higher.

low enrollment gap districts. These results suggest that the scholarship retained some older students, or induced those whose studies were interrupted to return to school. In column (3), we find that girls were 3 percentage points less likely to be absent from the exam due to the scholarship, though this effect is reversed in high enrollment gap districts, with the same coefficient pattern for boys. The pattern is consistent with the scholarship increasing students' perceived readiness for the exam overall, but with the marginal student in high enrollment gap areas less prepared to take the exam.[22]

In addition to changes in the number and composition of students, changes in enrollment can also be accompanied by changes in school quality. Table A3 explores this possibility for high schools (grades 10-12), using the limited school quality data we have from the Ministry of Education. In the first two columns, we find no evidence of significant changes in the pupil-teacher ratio in response to the scholarship program. In column (4), we find that the percentage of female teachers in high enrollment gap districts fell 6 percentage points more than in low-gap districts in response to the program, significant at 10%. This decline is notable given the male dominance in the teaching profession in The Gambia (the mean female teacher percentage in our data is 8%).[23] These effects on student composition and school quality will be useful to bear in mind when interpreting results.

5.3 Student learning

Table 4, Panel (A) presents results from the main difference-in-difference regression (1). The program increased English scores and combined English and math scores for girls and boys. In English, the effect sizes are .19 standard deviations for girls and .15 for boys, with the estimate for boys more precise (5% versus 10%). Combined English and math

[22]The implications of these patterns of absences on test performance in response to the scholarship are ambiguous. If students are absent because they are likely to fail the exam, then lower absence rates could lead to higher average ability among remaining test takers. On the other hand, fewer absences could reflect an influx of marginal test takers who were less concerned about performance, leading to lower quality among test takers.

[23]We had also hoped to look at whether the proportion of certified teachers changed in response to the scholarship, but data on teacher certification is recorded only for a subset of years, leaving only 5 pre-treatment observations in the school panel.

scores increased by .09 standard deviations for girls and .11 for boys, with the estimates for boys again more precise. Panel (B) shows that additional years of program exposure had no significant effects on test scores for either girls or boys. The effect on boys' learning outcomes may reflect peer effect in way that is consistent with Hoxby (2000) who found evidence that gender composition is one avenue through which peer effect operate and found that in classroom with more girls there are significant math test score gains for boys.

Even with no effect on female students on average, comparing changes in their outcomes to male students could still be instructive. The triple-difference specification of regression (2) makes this comparison, with results in Table 5. Panel (A), columns (1)-(3) show no difference in program effects between female and male students in the full sample. Limiting the sample to test centers in high enrollment gap districts in columns (4)-(6) reveals that girls in these districts perform .06 standard deviations better in math than boys as a result of the program, with the difference significant at 1%. No such differential effects are present in low enrollment gap districts (columns 7-9). It is not clear, however, whether the effect in high enrollment gap districts occurred because girls induced to take the test via scholarship receipt are more able than boys, or if the scholarship program re-oriented school resources and pedagogy in a way that benefitted girls more.

Table 5, Panel (B) repeats the exercise using years of program exposure as the treatment variable. For each additional year of program exposure, girls performed .006 standard deviations worse than boys in English. Although this difference is statistically significant at the 5% level, it is small, because even a girl exposed to the program from grade 7 would be expected to perform only $.006 \times 6 = .036$ standard deviations worse in English than a boy. A similar negative effect also appears for girls in high enrollment gap districts, but it is also small.

5.4 Treatment effect heterogeneity

As discussed earlier, the effect of the girls' scholarship program on student learning is theoretically ambiguous. Fee elimination could free students from the need to engage in income-generating activity or reduce stress, thereby improving performance. On the other hand, an influx of new students could lower the quality of the average student or place strain on school resources and harm the learning environment. We would expect these latter effects to be more likely in places with lower existing resources among schools or households. We explore this possibility by testing whether the program's effect differs according to pre-treatment characteristics. To some extent we have already done this through interactions or splitting the sample by district enrollment gap in Tables 3 and 5 , but we expand our inquiry here.

We augment the difference-in-differences specification of equations (1) and (3) to include interactions with pre-treatment district characteristics. These characteristics, all taken from the 1998 Integrated Household Survey, are: an indicator for having a high enrollment gap, defined as being below the median enrollment rate among secondary school-aged (13-18) youth; an indicator for being at or above the median rural population percentage; and an indicator for being at or above the median level of a household asset index.[24] Table 6 shows results for combined English and math scores.[25] In columns (1) and (4), we find no differences in program impact between high- and low-enrollment gap districts, regardless of whether the treatment is considered binary or continuous. In column (2), we find that girls in districts with rural population percentage at or above the pre-treatment median perform .225 standard deviations worse on math and English, or .04 standard deviations per year of program exposure, significant at 1%. Results for boys in column (5) are similar. The magnitude of the coefficients for the binary treatment in Panel (A) are large enough to make the program effect negative in the most rural districts.

[24]The asset index is the first principal component of the following assets: bicycle, car, refrigerator, motorcycle, sewing iron, television, radio, VCR.

[25]Sample sizes drop relative to Tables 4 and 5 because not all districts are represented in the 1998 household survey. Because the survey is nationally representative, however, the dropped observations are missing at random, which will make our results less precise but still unbiased.

In column (6), girls in districts with a household asset index at or above the median perform .027 standard deviations better with each additional year of program exposure, though the effect for boys is not statistically significant. These results present some evidence, albeit limited, that students in better-off districts gained most from the program. This result is not surprising, as those are the districts where the program may have worked more on the intensive margin rather than the extensive margin. That is, in better-off districts, students would be more likely to attend school even in the absence of the program, allowing scholarship receipt to ease finance-related stresses on academic performance. In worse-off districts, the scholarship is more likely to retain students who otherwise would have dropped out, or induce enrollment among less academically prepared students previously out of school.[26]

6 Conclusion

This paper evaluated the effect of the Gambian girls' scholarship program on the quantity, composition, and achievement of secondary school students. Our approach relied on difference-in-differences estimation, comparing regions that received the program early to those that received it late. We demonstrated the validity of this identification strategy by verifying that outcome trends were similar across regions prior to treatment. We found that the number of students taking the high school exit exam increased due to the girls' scholarship program, consistent with the presence of financial constraints on enrollment in secondary school. These results confirm those of Gajigo (2012), who found increased enrollment among girls aged 13-18, and extend them in two important ways. First, because our results are based on the number of students sitting the Grade 12 exit exam, they demonstrate that the effects of the scholarship program persisted throughout secondary school, rather than

[26]Limiting the sample to students who are 20 years old or less, who are less likely to have started school late, repeated a grade, or returned to school after dropout, leads to largely similar results as in Table 4. The exception is Math results for girls, which are -.14 standard deviations lower in response to treatment (significant at 5%). This suggests that the increased average age of students found in Table A2 is not an important indicator of student quality, or that the direction of selection is not obvious. Results not shown but available upon request.

being limited to earlier grades. Second, we find increases for both girls and boys, though the estimates for girls are less precise.

We also find changes in the composition of students in response to the scholarship. The scholarship increased the share of students in private schools, but only in districts with a low secondary enrollment gap, where students are less likely to be constrained by transport costs or lack of choice. Students were also more likely to be absent from the exam in high enrollment gap districts, and boys were more likely to be older, consistent with their re-enrollment in school following an interruption. We find no changes in school resources in response to the scholarship, though data limitations prevent us from ruling out this channel entirely.

Test scores increased in response to the scholarship, with combined English and math scores rising by .09 standard deviations for girls and .11 standard deviations for boys. These gains were concentrated in English (.19 s.d. for girls, .15 s.d. for boys). Evidence of learning gains are striking, given that the marginal student induced to enroll due to the scholarship program is likely to be of lower ability than average. A natural question to ask, therefore, is whether the changes in student composition induced by the program can explain the results. Our finding that the scholarship increased the share of students in private schools, where the average student scores lower than in public schools, points in this direction. Closer inspection suggests that sorting of weaker students into private schools cannot fully explain increases in learning, however. Increases in private school enrollment due to the scholarship did not occur in high enrollment gap districts, yet these districts saw gains in math in response to the scholarship. Moreover, these gains in math were even higher for girls than for boys (.06 s.d. greater than boys' gains of .08 s.d.), whereas the marginal girl affected by the scholarship program in high enrollment districts should be negatively selected. Siphoning of weaker students to private schools is not likely to explain learning gains from the scholarship.[27]

[27] However, low enrollment gap districts saw increases in both private school enrollment and English scores. These phenomena could be related if private schools attract students with a stronger connection to their traditional language or focus less on English instruction, suggesting another interesting dimension along which sorting could have occurred.

Instead, our interpretation is that the conventional view that students induced to enroll by fee elimination are negatively selected does not hold in our context. In The Gambia, completing high school is rare, particularly for girls. Taking the high school exit exam is a considerable accomplishment in this context, and those who remain enrolled long enough to do so were likely among the stronger students in earlier grades. Among the set of students in all grades who benefitted from the scholarship program, those who remained in school long enough to sit the exam are more likely to be positively selected, relative to both scholarship beneficiaries and the average student.

More broadly, our results suggest that improving access to secondary education in countries where enrollment is low need not come at the expense of student learning. As developing countries increasingly turn their attention to secondary school, finding policies to promote both opportunity and achievement should sit high on the agenda.

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Tables

Table 1: Summary statistics

	1998	2005	2012
male			
test takers	749	1,161	1,404
English	-0.27	-0.20	-0.08
math	-0.06	-0.14	-0.13
combined	-0.21	-0.20	-0.12
female			
test takers	210	624	846
English	-0.52	-0.34	-0.27
math	-0.23	-0.21	-0.25
combined	-0.46	-0.32	-0.30
female proportion	0.22	0.35	0.38

Sample is public schools in Regions 2-6. Z-scores based on universe of students taking exam in that year, including private schools and Region 1.

Table 2: Pre-treatment trends

			girls				boys	
	count	English	math	combined	count	English	math	combined
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
time (years prior to treatment)	-1.3	0.02	-0.013	0.008	-4.8	-0.021	-0.007	-0.006
	(4.5)	(0.031)	(0.051)	(0.045)	(6.3)	(0.038)	(0.013)	(0.015)
time*1(region=3,4)	7.2	-0.01	0.003	0.01	14.3	0.034	0.03	0.043
	(6.7)	(0.112)	(0.060)	(0.100)	(16.6)	(0.066)	(0.038)	(0.035)
time*1(region=5,6)	4.1	0.041	-0.026	0.027	3.9	-0.067	-0.017	-0.041
	(3.1)	(0.113)	(0.070)	(0.103)	(14.5)	(0.130)	(0.081)	(0.106)
Observations	38	1,380	1,380	1,380	38	3,738	3,738	3,738
R-squared	0.67	0.3	0.33	0.4	0.6	0.27	0.3	0.37
p-value on region-specific trends	0.43	0.87	0.88	0.96	0.70	0.73	0.37	0.48
Mean outcome	35.5	-0.28	-0.19	-0.27	93.8	-0.22	-0.09	-0.17

"Count" is number of test-takers, by test center. Standard errors clustered by test center. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include test center and year fixed effects. Regressions for test score outcomes include age, age squared, test center and year fixed effects.

Table 3: Girls' scholarship program and test-takers

	girls				boys				proportion female	
	test-takers		private share		test-takers		private share			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
girls' scholarship program	26.1	24.2	0.21	0.24	42.6	38.4	0.21	0.24	0.03	0.03
	(11.1)**	(12.6)*	(0.11)*	(0.13)*	(21.9)*	(24.8)	(0.07)***	(0.09)**	(0.03)	(0.04)
program*high enrollment gap		12.1		-0.32		27.8		-0.27		0.02
		(20.0)		(0.18)*		(25.2)		(0.15)*		(0.06)
Observations	184	184	184	184	184	184	184	184	184	184
R-squared	0.6	0.6	0.84	0.85	0.67	0.68	0.85	0.86	0.64	0.64
Mean outcome	40.5	40.5	0.32	0.32	78.2	78.2	0.25	0.25	0.34	0.34

Test-takers and proportion female refer to public (scholarship-eligible) test centers only. Sample is district panel, 1998-2012. All regressions include district and year fixed effects. Regressions for private share and proportion female weighted by number of test-takers. Standard errors clustered by district. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Girls' scholarship program and test scores

	girls			boys		
	English	math	combined	English	math	combined
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: program receipt						
girls' scholarship program	0.192	-0.073	0.089	0.154	0.024	0.113
	(0.095)*	(0.053)	(0.052)*	(0.065)**	(0.093)	(0.052)**
R-squared	0.32	0.2	0.35	0.23	0.17	0.27
Panel B: years exposed to program						
years exposed to program	0.089	-0.024	0.046	0.114	0.026	0.088
	(0.054)	(0.027)	(0.040)	(0.057)*	(0.045)	(0.056)
R-squared	0.32	0.2	0.35	0.23	0.17	0.27
Observations		7,997			15,811	

Standard errors clustered by test center. * significant at 10%; ** significant at 5%; *** significant at 1%. Includes age, age squared, test center and year fixed effects.

Table 5: Girls' scholarship program and test scores: triple difference

	full sample			high enrollment gap			low enrollment gap		
	English	math	combined	English	math	combined	English	math	combined
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: program receipt									
girls' scholarship program	0.162	-0.002	0.104	0.005	0.078	0.028	0.205	-0.049	0.087
	(0.072)**	(0.079)	(0.038)**	(0.013)	(0.010)***	(0.011)**	(0.080)**	(0.060)	(0.032)**
program*female	-0.001	0.015	0.017	-0.012	0.058	0.032	-0.007	-0.017	-0.003
	(0.027)	(0.027)	(0.029)	(0.031)	(0.019)***	(0.021)	(0.020)	(0.023)	(0.023)
R-squared	0.25	0.17	0.29	0.13	0.05	0.12	0.32	0.22	0.36
Panel B: years exposed to program									
years exposed to program	0.111	0.01	0.078	-0.055	0.204	0.077	0.078	-0.019	0.039
	(0.055)*	(0.041)	(0.050)	(0.096)	(0.034)***	(0.055)	(0.053)	(0.044)	(0.045)
years exposed*female	-0.006	0.001	-0.002	-0.009	0.002	-0.004	-0.004	-0.003	-0.003
	(0.003)**	(0.004)	(0.003)	(0.005)*	(0.006)	(0.005)	(0.004)	(0.004)	(0.004)
R-squared	0.26	0.17	0.29	0.13	0.06	0.12	0.32	0.22	0.36
Observations		23,808			6,664			14,383	

High/low enrollment gap based on splitting sample into below/at or above median secondary-age (13-18) children enrolled in school, by district in 1998. Standard errors clustered by test center. * significant at 10%; ** significant at 5%; *** significant at 1%. Includes age, age squared, test center and year fixed effects.

Table 6: Treatment effect heterogeneity

	English & math combined					
		girls			boys	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: program receipt						
girls' scholarship program	0.051	0.127	-0.045	0.052	0.119	-0.014
	(0.045)	(0.034)***	(0.087)	(0.042)	(0.075)	(0.082)
program*district x	0.037	-0.225	0.130	0.046	-0.219	0.088
	(0.065)	(0.029)***	(0.084)	(0.087)	(0.095)**	(0.131)
R-squared	0.37	0.37	0.37	0.31	0.31	0.31
Panel B: years exposed to program						
years exposed to program	0.025	0.059	0.002	0.049	0.079	0.022
	(0.036)	(0.030)*	(0.029)	(0.041)	(0.039)*	(0.043)
years exposed*district x	0.004	-0.039	0.027	0.019	-0.046	0.019
	(0.007)	(0.009)***	(0.012)**	(0.011)	(0.015)***	(0.025)
R-squared	0.37	0.37	0.37	0.31	0.31	0.31
Observations	11,709	11,709	11,709	17,883	17,883	17,883
District characteristic	enrollment gap	rural	assets	enrollment gap	rural	assets

Enrollment gap = below median secondary-age (13-18) enrollment rate. Rural = at or above median rural population proportion. Assets = at or above median household assets, by first principal component. All characteristics are by district in 1998. Standard errors clustered by test center. * significant at 10%; ** significant at 5%; *** significant at 1%. Includes age, age squared, test center and year fixed effects.

Table A1: Public versus private school students

	Public	Private	Difference
Girls			
test takers	6,777	4,362	2,415
English	-0.26	-0.42	0.16***
math	-0.22	-0.24	0.03***
combined	-0.28	-0.39	0.11***
age	19.6	19.6	-0.1***
absent	0.02	0.02	0.00
Boys			
test takers	12,405	3,817	8,588
English	-0.14	-0.35	0.22***
math	-0.10	-0.23	0.12***
combined	-0.14	-0.34	0.2***
age	20.1	20.3	-0.2***
absent	0.03	0.04	-0.02***
female proportion	0.35	0.53	-0.18***

Test takers in post-treatment periods only. "Absent" refers to absence from English subject exam, math subject exam, or both. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A2: Girls' scholarship and composition of test takers

	girls				boys			
	age		absent		age		absent	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
girls' scholarship program	0.1	0.1	-0.03	-0.03	0.2	0.2	-0.02	-0.03
	(0.1)	(0.1)	(0.01)*	(0.01)**	(0.11)*	(0.1)	(0.02)	(0.02)
program*high enrollment gap		0.2		0.04		0.3		0.05
		(0.2)		(0.02)*		(0.09)***		(0.02)**
Observations	7,234	7,234	7,385	7,385	13,813	13,813	14,190	14,190
R-squared	0.04	0.04	0.08	0.08	0.03	0.03	0.06	0.06
No. of clusters	30	30	30	30	30	30	30	30
Mean outcome	19.6	19.6	0.02	0.02	20.2	20.2	0.03	0.03

"Absent" refers to absence from English subject exam, math subject exam, or both. Regressions includes test center and year fixed effects. Standard errors clustered by test center. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A3: Girls' scholarship and school quality

	pupil-teacher ratio		female teacher %	
	(1)	(2)	(3)	(4)
girls' scholarship program	-33.6	-33.1	0.02	0.02
	(29.7)	(28.2)	(0.03)	(0.03)
program*high enrollment gap		-5.4		-0.06
		(21.0)		(0.03)*
Observations	254	254	254	254
R-squared	0.30	0.30	0.48	0.49
No. of clusters	31	31	31	31
Mean outcome	37.2	37.2	0.08	0.08

Regressions include school and year fixed effects. Weighted by enrollment. Standard errors clustered by school.* significant at 10%; ** significant at 5%; *** significant at 1%. Source: School panel 1998-2012, from Education Management Information System (EMIS), maintained by Gambian Ministry of Basic and Secondary Education.

Figures

Figure 1: The Gambia and its regions

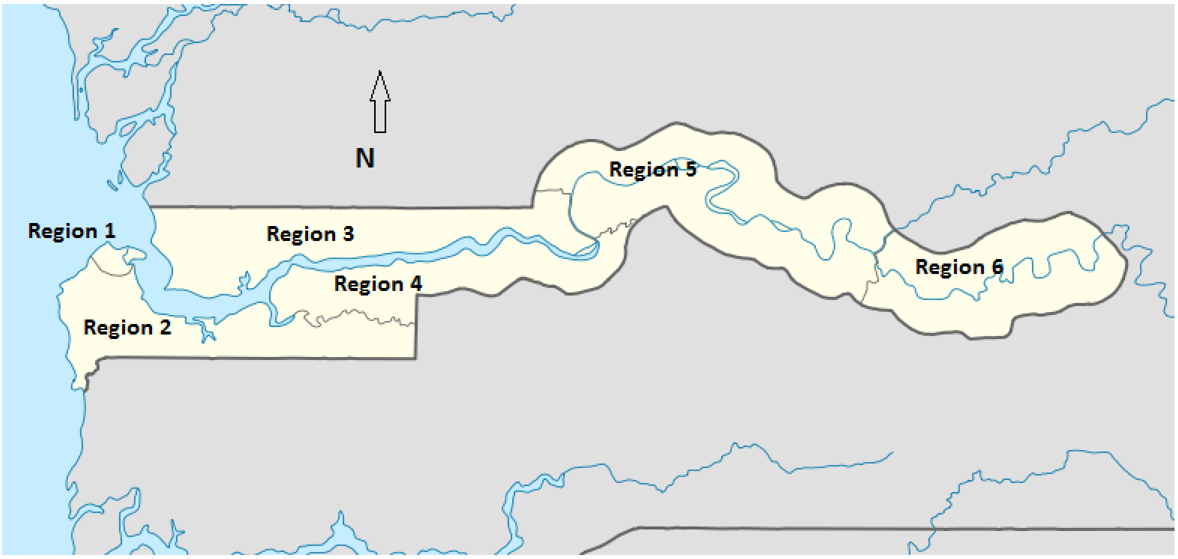
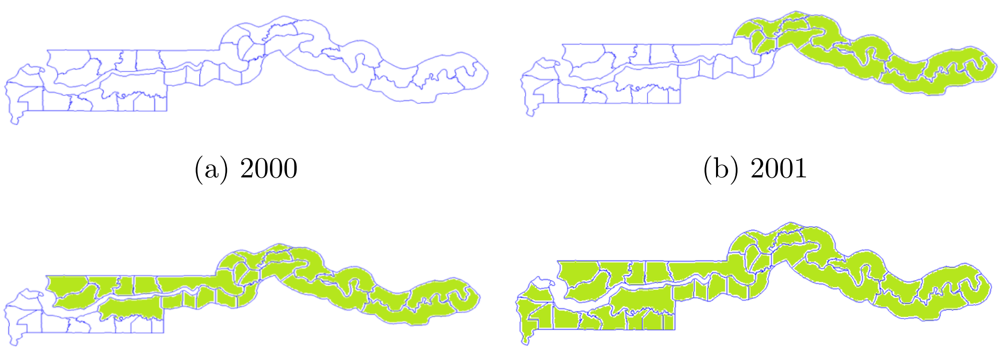


Figure 2: Girls' Scholarship Program Implementation



(a) 2000

(b) 2001

(c) 2002

(d) 2004

Figure 3: Female enrollment percentage, Grades 7-12

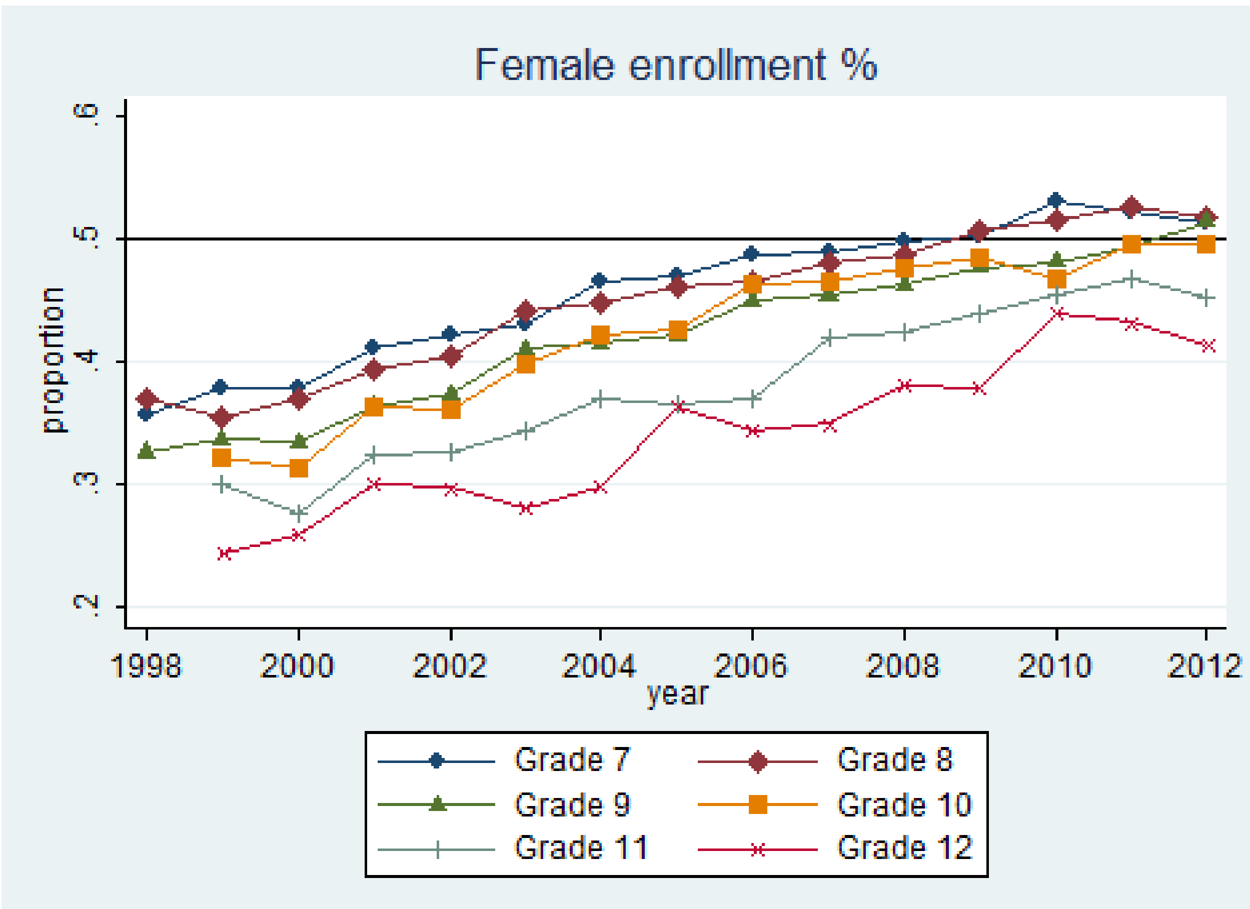


Figure A1: Gambia Middle and High Schools

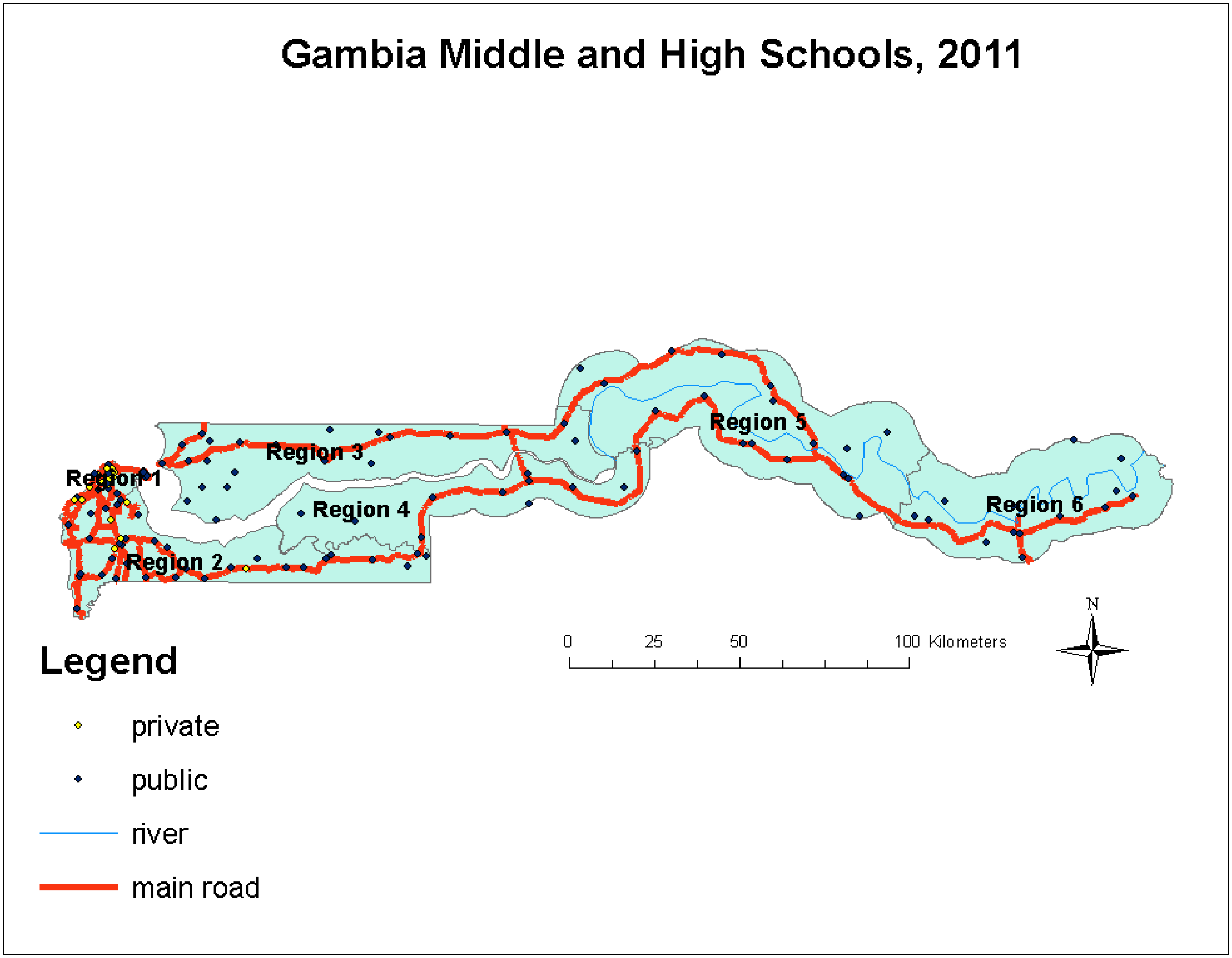
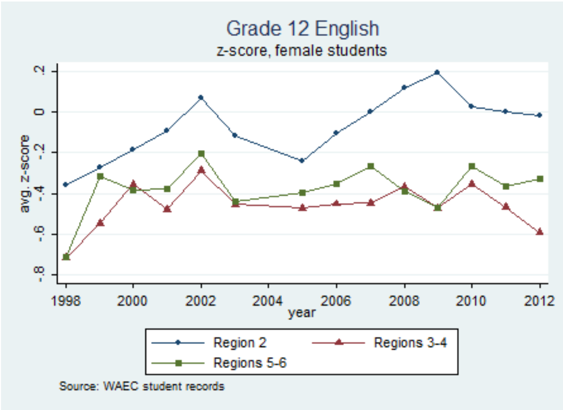
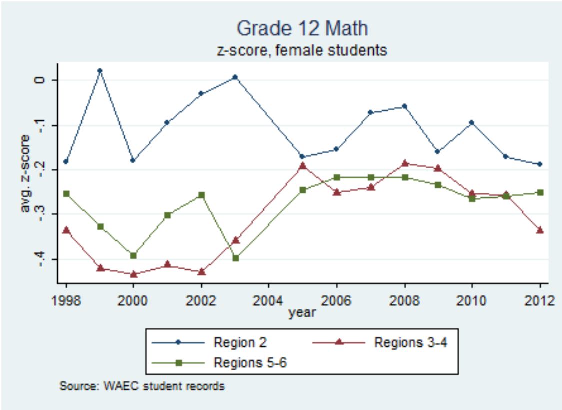


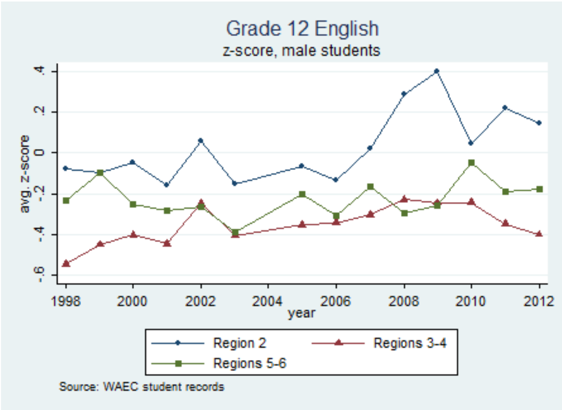
Figure A2: Test Scores, by subject and gender



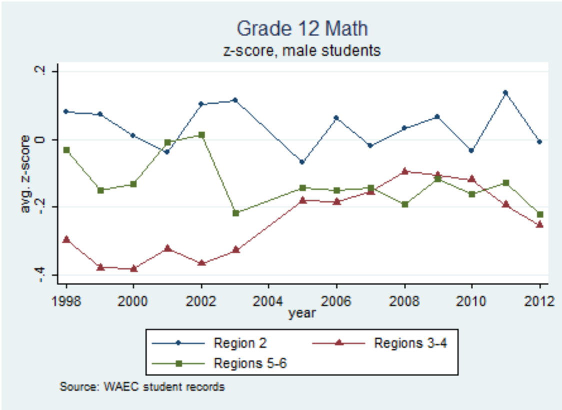
(a) English, female



(b) Math, female



(c) English, male



(d) Math, male