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Does Free Primary Education Narrow Gender Differences in Schooling? Evidence from Kenya†

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Abstract

We identify the impact of the 2003 Kenyan Free Primary Education (FPE) programme on gender imbalances in the number of students graduating from primary school and achievement on the primary school exit examination. Our identification strategy exploits temporal and spatial variations in the pre-programme dropout rates between districts in a difference-in-differences strategy. We find that the programme boosted primary school completion rates of both boys and girls, but had a larger effect for boys, thereby increasing the gender gap in graduation. Additionally, the programme led to a widening of the achievement gap in government schools. Overall, FPE increased educational access, but did not close gender gaps, suggesting that complementary programmes that specifically target girls may be necessary to reduce these gaps.

JEL classification: I21, O15, H52, J16

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1. Introduction

Developing countries have invested heavily in efforts to achieve universal primary education and to eliminate gender disparities in primary education. Sub-Saharan Africa has made encouraging progress towards eliminating these gender gaps. For instance, from 2000 to 2009, the ratio of female to male primary school completion rates increased from 0.83 to 0.89 (World Bank 2012). Despite the convergence in primary school completion rates observed in the region over the past decade, additional gender disparities in primary education still remain. For example, the female completion rate was approximately 8 percentage-points lower than the male completion rate in 2009. Moreover, from 2000 to 2007, in Kenya, the setting for this study, girls scored about 0.2 standard deviations lower than boys on standardised grade 8 examinations.[2] Given the large body of evidence that highlights the importance of female education for development and growth, the improving trends and remaining gaps could have important economic and social implications in the region.[3]

Since 1994 over a dozen African countries have implemented fee elimination programmes to support the goal of universal primary education. While there is growing evidence that such programmes have improved educational access, especially among the poor, the extent to which these programmes can reduce the gender gaps in primary school completion and achievement is yet to be determined. This paper uses a unique combination of administrative and census data to examine the extent to which programmes such as the Kenyan Free Primary Education (FPE) programme can close the gender differentials in primary school completion and achievement.

Prior studies have shown that interventions that elimiate government primary school fees have the potential to boost enrollment; however, these studies generally do not examine primary school completion or achievement. Deininger (2003) and Nishimura *et al.* (2008) found that the Ugandan Universal Primary Education programme led to an increase in enrollment with a larger effect for girls. Grogan (2009) found that the same programme decreased the probability of delayed school entry,

[2] Author's calculation based on KNEC data described in the data section below.

[3] See Lockheed *et al.* (1980), Schultz (1993), Schultz (1988), Hanushek and Kimko (2000), Behrman and Sengupta (2002) and Malhotra *et al.* (2003) for examples of studies examining the relationship between female education and a host of outcomes such as GDP per capita, the number of women in the formal labor market, labour productivity, infant and child survival, and also the education of subsequent generations.

especially for girls. In Kenya, Lucas and Mbiti (2012) found that FPE increased the number of students completing primary school and caused small achievement declines. Bold *et al.* (2011) similarly found that the same programme increased student access. However, neither paper examined the differential effects of the programme by gender. In addition to the literature on free primary education programmes, other studies have focused on targeted demand-side education policies in Latin America. Barrera-Osorio *et al.* (2007) found that the targeted fee reductions in Bogotá, Colombia, increased primary school enrollment equally for both genders. Schultz (2004) estimated that the PROGRESA programme of conditional cash transfers in Mexico led to an increase in the attendance of those who were targeted, with larger increases for girls.

This study uses the FPE programme in Kenya to examine the impact of the nationwide elimination of government school fees on primary school completion and student achievement on the primary school exit examination. In January 2003, the Kenyan government abolished all school fees in government primary schools, reducing the private cost of attending these schools. We exploit differences across districts in the pre-programme dropout rates to identify the effect of FPE. Intuitively, the programme has a very low effective intensity in districts with high primary school completion rates and a much larger intensity in districts with a high dropout rate. We combine this differential effective intensity across districts with a difference-in-differences strategy to identify the effect of FPE on primary school completion and achievement by gender. We find that FPE increased access for both genders, but that boys responded to the programme in greater numbers than girls, widening the completion gap. This widening was partly driven by the differential response of boys older than 17 relative to similarly aged girls. Not surprisingly, most of the increase in completion happened within government schools. Additionally, FPE did not affect the gender gap in aggregate test scores, although it did widen the achievement gap in government schools and affect the achievement gap in subject-specific examinations.

2. Primary education in Kenya

The Kenyan educational system consists of eight years of primary, four years of secondary and four years of university education. Students are eligible to start grade 1 when they are six years old or older at the start of the school year in January. Students are required to take the national Kenya

Certificate of Primary Education (KCPE) examination in order to graduate from primary school.

Almost all children attended at least a limited amount of primary school prior to FPE. However, delayed entry, grade repetition and dropping out were very common. Prior to the FPE programme, 89% of 18–20 year olds had completed grade 1, but only 47% had completed grade 8 (1999 Kenyan Census). On average, girls started school later than boys. Prior to the reform, the average age of girls in grade 1 was 7.2 years compared with 6.4 years for boys (World Bank, 2004). Approximately 13% of students repeated a grade in primary school; however, these repetition rates did not differ by gender (World Bank, 2004). In the three years prior to FPE, the combination of dropping out and not starting school led to on average 95 girls for every 100 boys graduating primary school, resulting in almost 14,000 more boys than girls completing primary school each year. For those who graduated, the average exit examination score for girls in the three years prior to FPE was a quarter of a standard deviation below the average score of boys.

Prior to 2003, all government primary schools charged fees to students. These fees varied by school and were used to finance the operations of the school (e.g. textbooks, construction and maintenance of physical facilities). The central government provided schools with teachers and paid their salaries through the national Teacher Service Commission (World Bank, 2004). Following the December 2002 elections, the newly elected government eliminated all government primary school fees effective at the start of the 2003 school year in January. Under the FPE programme, schools were given 1,020 KSh (approximately US$14) per pupil to cover the formerly collected school fees. This capitation grant was often less than the previously collected school fees (Alubisia, 2004). The funding supported school operations, while the government continued to pay teachers' salaries. Parents were still responsible for other expenses such as uniforms, meals and transportation, which continued to act as barriers to educational access for some children.

3. Theoretical framework

A canonical model of parental investment in education, such as Alderman and King (1998), generates a decision rule where parents invest in a child's education if the marginal benefit of an additional year of education exceeds the marginal cost. While the FPE programme lowered the marginal cost of

school attendance for both boys and girls, the response to the programme could be differential by gender for a number of reasons.

First, children are engaged in different activities in lieu of school. Panel A of Table 1 displays the activities of children aged 6–15 who had not completed primary school pre-FPE (calculations based on 1999 Kenyan Census). Approximately the same percentage of girls and boys were attending primary school (40.5%). A higher percentage of boys than girls were employed while the opposite is true for being engaged in housework.

Table 1: Reasons for Not Attending School

	All (%)	Male (%)	Female (%)
Panel A: survey response to 'What was your main activity in the last 7 days?' (individuals aged 6–15 who had not completed primary school)			
Activity			
In school	40.5	40.5	40.5
Not in school	59.5	59.5	59.5
Employed	36.4	38.5	34.3
At work, not family holding	2.0	2.0	1.9
At work, family holding, non-agricultural	2.6	2.7	2.6
At work, family holding, agricultural	30.9	32.8	28.9
Have a job, but did not work last week	1.0	1.0	1.0
Unemployed	3.7	3.6	3.9
For unspecified reasons	0.3	0.3	0.2
Because no work is available	3.5	3.3	3.6
Not in the labour force	19.3	17.5	21.3
Housework	12.3	10.2	14.4
Unable to work or disabled	0.5	0.6	0.5
Inactive, other reasons	6.5	6.7	6.4
Panel B: Survey response to 'Why are you not in school?' (individuals aged 6–15 who had not completed primary school)			
Reason			
Too expensive/cannot afford	39.8	40.4	39.2
School useless/uninteresting	23.9	28.4	19.6
Not stated/other	18.0	17.5	18.6
Illness	4.8	3.3	6.2
Must work in the home/field	3.7	2.2	5.2
Paid employment/apprentice	2.9	3.3	2.6
Failed exams	2.4	2.2	2.6
Pregnancy/married	2.1	0.6	3.6
Too old/too far	1.9	2.2	1.6
Cultural rituals	0.5	0.0	1.0

Notes: Panel A: calculated from 1999 Kenya Census. Panel B: calculated from 1997 WMS.

Second, some of the reasons for being out of school differ by gender. Panel B of Table 1 shows that prior to FPE school fees were the most commonly given reason for primary school-aged students of both genders to be out of school (calculations based on 1997 Welfare Monitoring Survey). Girls were more likely than boys to be out of school due to illness, having to work in the home or field, cultural rituals, or pregnancy and marriage. Boys were more likely to be out of school because they found it useless or uninteresting, were engaged in paid employment, or were too old or the school too far. Pregnancy or marriage was cited by 3.6% of girls and 0.6% of boys as the reason for not attending school.[4] These reasons are consistent with Lloyd *et al.* (2010) who found that enrollment differences between boys and girls emerge in Kenya when students become teenagers. Although the proportions citing work as the primary reason for not attending school were relatively low, boys were more likely to cite this reason than girls. Elimination of fees might have less of an effect on those who drop out of school due to marriage, pregnancy or cultural rituals since these events could be determined by social norms that are not affected by FPE.[5]

Third, even though approximately the same percentage of school-aged boys and girls were not in school because of the expense, differential (perhaps perceived) returns to education could affect the response. The canonical model of education investment suggests that parents should respond to the elimination of fees by investing more where the returns to education are higher. Thus if the (perceived or actual) returns to education were higher for boys relative to girls, then parents would continue to invest more in boys' education relative to girls, possibly exacerbating the educational gender gap.

Finally, fees could have represented a smaller percentage of total schooling expenditures for girls if, for example, parents spent more on girls' uniforms for the sake of modesty and transportation to ensure safety.[6]

Therefore, a number of factors could contribute to a differential effect of FPE by gender. Our estimates are the net effect of these factors.

[4] Girls who become pregnant are often barred from attending school even after the birth of the child (Duflo *et al.*, 2010).

[5] In Busia District Kenya, Duflo *et al.* (2010) found that the provision of free uniforms decreased, but did not eliminate, the number of female students who dropped out because of pregnancy.

[6] We thank an anonymous referee for this point. Unfortunately, our data do not permit us to measure this possibility.

4. Empirical strategy

The primary conceptual difficulty in estimating the effect of a nationwide FPE programme is its simultaneous implementation throughout the country. Our identification strategy follows that of Lucas and Mbiti (2012). The approach relies on pre-existing district-level heterogeneity. These districts, then, are all subject to the same intervention, but the effect varies based on the pre-programme differences. Such an approach is common in the applied literature (e.g. Bleakley 2007; Cutler *et al.* 2010; Lucas 2010). In the present context, pre-FPE differences in grade-specific drop-out patterns within a district create spatial variation that we combine with temporal variation (i.e. the sharp policy change) from the start date of FPE. We exploit this temporal and spatial variation to identify the impact of FPE through a difference-in-differences approach while controlling for time invariant district attributes through district dummy variables and nationwide differences between years with year dummy variables.

Even though the programme was nationwide, the effective intensity of the programme for a district in a given year varied by the number of students whose decisions about school completion could have been changed by FPE. Pre-FPE if students dropped out of primary school at a high rate, then that district would be more intensely treated by FPE as a higher percentage of pupils could be induced by FPE to stay in school. Our measure of the effective intensity varies by the district in which the student took the examination and the year in which he took it. Additional details on the calculation of intensity for each district-year appear in Section 5.

Formally, in our main empirical specification, we aggregate individual data from the KCPE examination to the gender–district–year level and implement a modified difference-in-differences specification:

$$y_{gjt} = \alpha + \beta_1 \,\text{intensity}_{jt} + \beta_2(\text{intensity}_{jt} \times \text{female}_g) + \beta_3 \,\text{female}_g + \delta_j + \delta_j \times \text{trend}_t + \delta_t + \varepsilon_{gjt} \quad (1)$$

where y_{gjt} is the outcome for gender g in district j in year t (e.g. number of graduates or test scores), intensity_{jt} is the effective intensity of the programme (discussed more in Section 5), female_g is a dummy variable equal to one for female test takers, δ_j are district fixed effects, $\delta_j \times \text{trend}_t$ are district-specific linear trends for all but one district and δ_t are year fixed effects. ε_{gjt} is the error term. Following Bertrand *et al.* (2004), we allow the error term to be correlated within districts but assume it is

independent across districts. β_1 measures the effect of FPE on boys, β_2 measures the differential effect of FPE on girls and $\beta_1 + \beta_2$ measures the total effect of FPE on girls.

Our outcomes of interest, y_{gjt}, are the number of students who took the KCPE at the completion of grade 8 (a measure of primary school graduation) and the average KCPE scores (a national measure of achievement).

This empirical strategy leverages both temporal and spatial variations for identification. We control for country-wide differences between years with year dummy variables. District-fixed effects control for time invariant heterogeneity between districts, and district-specific linear trends control for underlying convergence or divergence between districts. Additionally, we provide a number of robustness checks of our specification in Section 7 that add further convincing evidence that our baseline results are not spurious.

We chose to focus on school completion rather than enrolment for a number of reasons. First, before FPE, almost 90% of 18–20 year old had completed grade 1, but fewer than 50% had completed primary school (calculations based on 1999 Kenyan Census). This suggests that persistence to completion is a more significant barrier to primary school completion than initial school enrolment. Second, prior to FPE, the primary school net enrolment rates of girls and boys were similar (UNESCO, 2005). Third, a student could be technically enrolled in school, but have no prospects of advancing to the next grade because of poor attendance due to a lack of fees. Finally, to our knowledge, data on enrolment that are as reliable as the National Examination Council data do not exist over the period of study.

5. Data

To evaluate the effect of FPE on the gender gaps in education, we use several sources of data. Data from the Kenyan National Examination Council contain student-level KCPE scores for all test takers in Kenya from 2000 to 2007. These data also contain information on individual and school attributes such as the student's gender, age and district and also whether the student's school was government or private. Using these data we compute the number of students completing primary school (equivalent to the number of test takers) and mean KCPE performance at the gender–district–year level.

Prior to the introduction of FPE in 2003, only 53% of students who started primary school completed it, with attrition occurring between each grade (calculation from 1999 Census). As each district had a specific attrition pattern prior to the introduction of FPE, we exploit the pre-programme variation in these patterns to construct a programme intensity measure that captures the differential potential response to the programme across districts and over time. Specifically, based on the pre-programme attrition pattern for each district, we can compute the number of students who could be induced to complete primary school relative to the number who were completing it prior to the programme. The same strategy is used in Lucas and Mbiti (2012).[7]

We compute a separate intensity_{jt} for each district–year from district-level completion rates for each grade prior to the programme using the 5% IPUMS sample of the 1999 Census.[8] For each district–year, our intensity measure captures the percentage increase in the number of primary school graduates (KCPE test-takers) under the assumption that FPE would eliminate all future primary school attrition for the relevant test taking cohort.[9] We set the pre-FPE level of intensity to 0 in all districts (i.e. $\text{intensity}_{jt} = 0$ for $t < 2003$) since the programme was not in effect for these cohorts. In January 2003, FPE was implemented nationally. Students who may have dropped out of school during the transition from grades 7 to 8 (due to fee reasons) could now be encouraged by FPE to stay in school and complete grade 8. Thus, in the first year of the programme, we compute the intensity in each district as the number of students who completed grade 7 but dropped out between grades 7 and 8 pre-FPE, divided by the eighth grade cohort. We compute the intensity for the 2004 KCPE cohort by imposing an attrition rate of 0 for the transition from the end of grade 6 (December 2002) up to the KCPE (grade 8 in 2004). Thus, the programme intensity measure for the 2004 cohort is calculated as the number of individuals who completed grade 6, but did not complete grade 8, divided by the number who were in grade 8. We repeat

[7] The discussion of the calculation of intensity borrows heavily from Lucas and Mbiti (2012).

[8] Due to the time period covered by the data (2000–2007), our programme intensity measure captures changes in transition rates between grades but not the entry of students who had not previously attended primary school.

[9] Our measure of programme intensity provides an estimate of the maximum impact that the programme could have. We cannot establish the exact number of students who dropped out for financial reasons prior to the programme.

this procedure to calculate district–year-specific programme intensity measures for all years in our data (2003 to 2007) across all of the districts.

We use the 1999 Census to compute the intensity measure as described above. We restrict the data to only focus on those younger than 18 and count the number who completed each grade in a given district.[10] We can then compute the number of individuals who dropped out after completing a given grade by subtracting the number of individuals who completed primary school or are still in primary school. As discussed above, we compute the cohort-specific intensity in a given year by dividing the number of students who would have dropped out by the size of the grade 8 cohort.[11]

Since our intensity measure is computed using data from 1999, we need to additionally assume that any changes in attrition patterns that occurred between 1999 and 2002 are uniform across the country or uncorrelated with prior attrition. We follow the same procedure above using the 1989 census and find a high degree of correlation between the 1989 and 1999 measures, suggesting the stability of the intensity measure. Since the year-fixed effects control for nationwide changes in attrition patterns and the intensity measures were relatively constant between 1989 and 1999, we feel that this is a valid assumption.

As the youngest cohort in our data (2007 KCPE cohort) was in grade 3 at the start of FPE, retention is the principle margin through which FPE would affect the cohorts in our data. The effects of new entry would not be observed until the 2010 KCPE cohort. Unfortunately, we do not have access to data more recent than the 2007 cohort. Alternative measures such as pre-programme schooling fees and non-enrolment rates would affect students who had never attended school as well as those who continued school due to FPE. These measures are better suited for an analysis that considers students who completed their entire primary school career under FPE (for example the 2010 cohort), where both entry and retention effects occur.

From the 1999 Census, we also compute the probability of marriage by various ages and the labor market return to primary school completion and district-level unemployment. We also use two nationally representative

[10] We use age 18 as the cut-off, since almost everyone who completes primary education does so prior to age 18. We include younger cohorts as their educational experience occurred closer in time to FPE.

[11] Detailed calculations of our intensity measure can be found in Tables A1 and A2 of Lucas and Mbiti (2012).

Table 2: Summary Statistics

Variable	Mean (standard deviation)
Number of graduates per year	532,401 (215,193)
Number of graduates per district per year	7,855 (6,165)
Number of graduates per school per year	33.8 (24.1)
Average age at graduation	15.2 (1.5)
Portion of graduates age 17 or older	0.187 (0.39)
Intensity	0.706 (0.75)
Portion female	0.479 (0.50)
Portion of graduates from government schools	0.924 (0.27)
District unemployment rate in 1999	0.072 (0.031)
Portion of 18 year olds in 1999 who had not completed Grade 1	0.063 (0.116)

Notes: Standard deviations appear in parenthesis next to the sample means. Graduates per year through portion of graduates from government schools: calculated from KNEC data 2000–2007. Unemployment and Grade 1 completion: calculated from 1999 IPUMS sample of the Kenyan census.

household surveys, the 2005 Kenya Integrated Household Budget Survey (KIHBS) and the 1997 Welfare Monitoring Survey (WMS), to provide additional and complementary insights into the role of household socioeconomic status (SES) and the impact of the programme on delayed enrolment. Finally, we use various combinations of these data to perform numerous robustness checks to ensure that our results are not being driven by differences in pre-programme school quality, other contemporaneous programmes or spurious in other ways.

Table 2 contains the sample means and standard deviations of our variables.

6. Results

Figure 1 provides initial evidence of the effect of FPE on the number of primary school graduates. Prior to FPE, the number of graduates per year was trending upwards, and the rate of growth increased after FPE. The rate of increase for boys and girls diverged in 2004, with a widening gender gap in subsequent years, narrowing only slightly in 2007. Even though the total number of girls graduating increased after FPE, girls as a percentage of all graduates decreased from a high of almost 49% in 2001 to 47% in 2006, as can be seen in Figure 2. Table 3 provides summary statistics separately for boys and girls before and after FPE for the number of students graduating, the average age and KCPE scores of graduates. These crude comparisons suggest that fewer girls responded

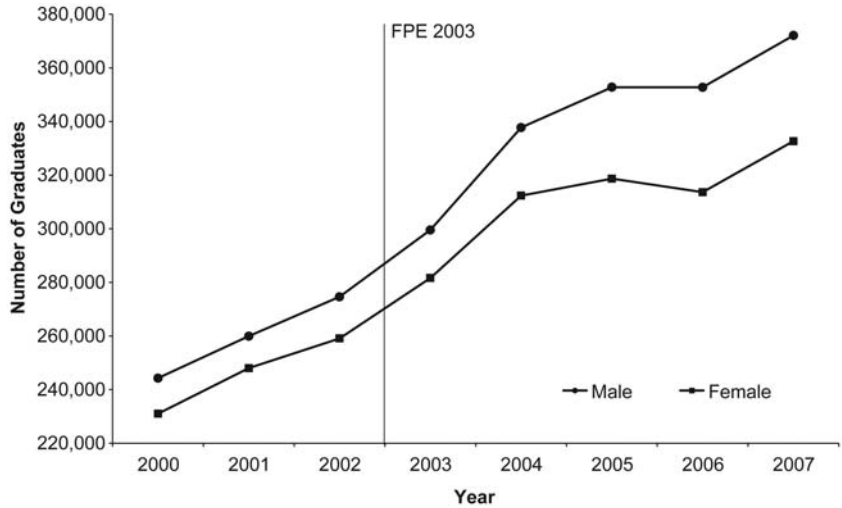

Figure 1: Number of Students Graduating Primary School by Gender. *Note:* Calculated from KNEC Data.

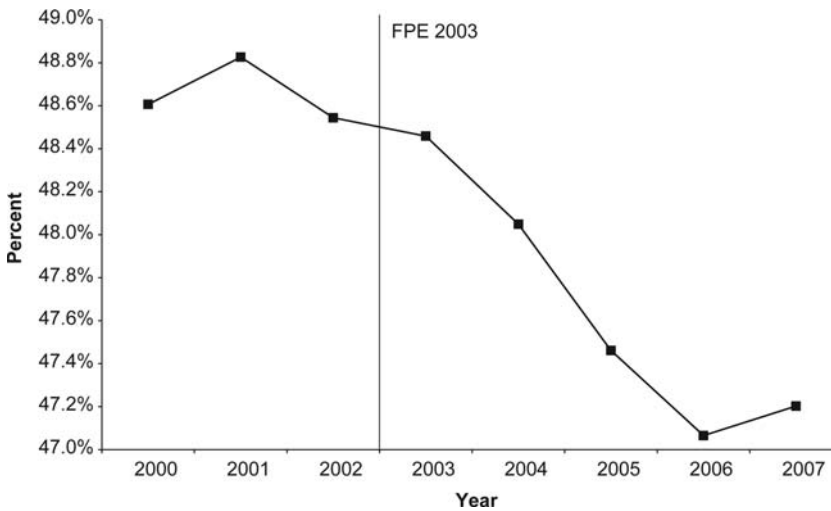

Figure 2: Girls as a Percentage of All Primary School Graduates. *Note:* Calculated from KNEC Data.

to FPE, their average age at graduation became younger, and the gender gap in achievement decreased. Of course, these aggregated figures do not separate the impact of FPE from other potential nationwide changes or trends.

Table 3: Time Series Comparison of Girls and Boys

	Pre-FPE	Post-FPE	Difference
Average annual number of primary school graduates			
Girls	246,038	311,791	65,753
Boys	259,610	342,976	83,366
			−17,613
Average age of primary school graduates			
Girls	15.09	14.98	−0.11
Boys	15.42	15.43	0.01
			−0.12
Standardised KCPE score			
Girls	−0.122	−0.116	0.005
Boys	0.115	0.101	−0.015
			0.020

Notes: Pre-FPE, students who graduated 2000–2002; Post-FPE, students who graduated 2003–2007. Calculations based on data from the Kenya National Examination Council.

The estimates of Equation (1) with the number of primary school graduates as the dependent variable appear in column 1 of Table 4. As expected, the number of graduates of both genders increased more in districts that were more intensely treated by the programme (i.e. from Equation (1), $\hat{\beta}_1 > 0$ and $\hat{\beta}_1 + \hat{\beta}_2 > 0$). The average value of our intensity measure post-FPE is approximately 1, indicating a 100% potential increase in the number of primary school graduates if all students who would have dropped out before FPE were induced by FPE to stay in school. Therefore, for a district of average intensity, the programme increased the number of male graduates by 472 and the number of female graduates by 219 (i.e. 471.6 plus negative 253.0), increasing access for both genders, but widening the gender gap in completion. These estimates imply an additional 8,999 male and 4,171 female students completed primary school due to FPE in 2003.

If part of this differential response was the result of girls having a lower price elasticity due to marriage or pregnancy, then older girls (who are more likely to be married or pregnant) should respond less to FPE. Column 2 contains estimates of Equation (1) with the average age at graduation as the dependent variable. There was no statistically significant change in the age of boys at primary school completion. However, female graduates became younger by 0.07 of a year relative to their male peers in a district of average intensity. This could reflect an increase in social promotion or a differential change in attrition patterns by age. An

Table 4: Effect of FPE on Number and Age of Primary School Graduates

Dependent variable	Number of graduates	Average age of graduates	Aged 17 or older	
			Number of graduates	Percentage of graduates
	(1)	(2)	(3)	(4)
Intensity	471.6*** (125.80)	−0.061 (0.050)	142.7*** (43.600)	−0.0195** (0.009)
Intensity × Female	−253.0*** (50.52)	−0.0736*** (0.013)	−148.0*** (31.790)	−0.0161*** (0.003)
Female	−179.5** (76.120)	−0.369*** (0.018)	−381.9*** (33.660)	−0.0907*** (0.005)
Coefficients on intensity + intensity × female = 0				
F-stat	4.10	6.40	0.01	15.46
p-value	0.05	0.01	0.91	0.00
Observations	1,104	1,104	1,104	1,104
R^2	0.99	0.96	0.92	0.94

Notes: Standard errors clustered at the district level appear in parentheses. All regressions include district time trends and district and year dummy variables. The unit of observation is district–year–gender. Data from KNEC.
*Significant at 10%.
**Significant at 5%.
***Significant at 1%.

alternative measurement of the effect of the programme on age at completion is the number of students who graduate at an age well above the age for grade.[12] The number of boys aged 17 or older increases, but there is no change in the number of similarly aged girls (column 3). Finally, older students are a smaller percentage of students (column 4). All students we observe started school before FPE; therefore, the change in age is not the result of a reduction in the delayed entry. Instead, an increase in the number of younger girls graduating could signal their higher price elasticity relative to older girls because they are less likely to be married or pregnant.[13] This pattern is consistent with Lloyd *et al.* (2010) who found enrolment differences between boys and girls emerge in Kenya when students become teenagers. All of these results point to FPE having a lesser effect on the schooling impediments of older girls.

If FPE increased the likelihood that girls enter school at age 6, then the lack of response of older girls would become less important over time as girls who start on time would reach graduation before age 17. We use the 2005 KIHBS to test for differential changes in delayed entry by birth cohort. We estimate an alternative to Equation (1) as a linear probability model in which treatment is determined only by birth cohort in a single difference framework to compare the probability of on-time school enrolment for individuals who turned 6 prior to FPE (i.e. born in 1996 or earlier) to individuals who turned 6 after FPE (i.e. born 1997 and later). The individuals born in 1997 would be age 6 in 2003 and thus would have the opportunity to start school under the free school regime, while those born earlier would have turned 6 under the fee-paying regime. Even though we include a linear trend, this cohort comparison provides only suggestive evidence as it does not separate FPE from other nationwide programmes.

The results in Table 5 show that girls who were 6 or younger at the time of FPE (i.e. born in 1997 or later) were 2 percentage-points more likely to enrol in school on-time than similarly aged boys. Boys were no more likely to enrol in school on time after FPE. Focusing on a narrower window of cohorts (column 2) approximately doubles the size of the estimate.

[12] If students start school on time at age 6 and have timely progression through primary school, then they should be about 14 at the time of the KCPE.

[13] This finding is also consistent with a decrease in grade repetition, perhaps because of enrolled students no longer having intermittent attendance due to lack of fee payment during the school year or because of an increase in social promotion due to overcrowding. We cannot empirically test these alternatives, but they are less likely than marriage or pregnancy to be differential by gender.

Table 5: Impact of FPE on the Timing of Primary School Entry

Dependent variable	Child starts primary school at age 6 or younger	
	(1)	(2)
FPE cohort	0.007 (0.0167)	0.00421 (0.0205)
FPE cohort × female	0.0237* (0.0127)	0.0380** (0.0147)
Female	−0.00349 (0.0101)	−0.0185 (0.0118)
Constant	0.840*** (0.0110)	0.846*** (0.0254)
Linear trends	Yes	Yes
Birth cohorts included	1993–1999	1995–1999
Coefficients on FPE-cohort + FPE-cohort × female = 0		
F-stat	4.38	5.58
p-value	0.04	0.02
Observations	12,848	9,476
R^2	0.19	0.18

Notes: Standard errors clustered at the district level appear in parentheses. FPE cohort is an indicator variable equal to 1 if an individual was born in or after 1997 (cohorts that were age 6 or younger at the time of FPE). The unit of observation is an individual.
*Significant at 10%
**Significant at 5%
***Significant at 1%.

A student's age at completion is determined by both the age at entry and any grade repetition. If repetition did not increase as a result of FPE, then girls who started primary school on time would reach graduation at a younger age, prior to being at risk of marriage and childbearing. Therefore, based on the increased likelihood of on-time matriculation, the gender gap in completion could narrow for the cohorts born in 1997 or later.

Deininger (2003), Bold *et al.* (2011) and Lucas and Mbiti (2012) showed that FPE programmes had larger impacts on individuals from poorer (or lower SES) households. We stack the 2005 KIHBS with the 1997 WMS to create a repeated cross-section of individual data to examine the heterogeneous responses by household income level to FPE. As the KIHBS data were collected in 2005, too soon after the implementation of FPE to examine completion rates with sufficient precision, we focus on current enrolment rather than completion. We use parental education (measured in years of schooling) as a measure of household SES and extend Equation (1) with triple interaction terms (a triple difference specification). The results of this exercise are shown in Table 6. Column 1 is the household survey analogue to column 1 of Table 4 with enrolment as the dependent variable. Consistent with the previous analysis, this column shows that both boys

Table 6: Differential Effects of FPE by Household SES

Dependent variable	Currently enrolled in primary school		
	(1)	(2)	(3)
Intensity	0.0270**	0.0681***	0.0563***
	(0.0126)	(0.0140)	(0.0116)
Intensity × female	−0.00332	−0.0134*	−0.00756
	(0.0024)	(0.0076)	(0.0062)
Intensity × paternal years of schooling		−0.00537***	
		(0.0009)	
Intensity × paternal years of schooling × female		0.00142*	
		(0.0008)	
Intensity × maternal years of schooling			−0.00581***
			(0.0009)
Intensity × maternal years of schooling × female			0.00101
			(0.0008)
Constant	0.766***	0.618***	0.608***
	(0.0202)	(0.0351)	(0.0348)
Coefficients on intensity × parental education + intensity × parental education × female = 0			
F-stat		23.94	30.82
p-value		0.00	0.00
Observations	30,465	19,706	24,492
R^2	0.14	0.16	0.16

Notes: Standard errors clustered at the district level appear in parentheses. Repeated cross-section data from 2005 KIHBS and 1997 WMS. Parental education is defined as years of schooling. All specifications include: female times father's education or female times mother's education and female, urban, age, grade and district dummy variables.
*Significant at 10%.
**Significant at 5%.
***Significant at 1%.

and girls responded to the FPE programme. Unlike the graduation estimates, we do not find a statistically different response by gender. Columns 2 and 3 use the years of parental education, separately of fathers and mothers, as a measure of household SES in a triple difference framework. The results in column 2 show that those most likely to be induced by FPE to enrol in school are children from low SES households (low paternal education). In expectation, in a district with average intensity, FPE caused a boy whose father had no formal schooling to be 6.8 percentage-points more likely to be enrolled, with a decrease of 0.5 percentage-points for each additional year of paternal schooling. The corresponding numbers for a girl are 5.4 percentage-points (0.0681−0.0134)

and 0.4 percentage-points ($-0.00537 + 0.00142$). Therefore, the lowest SES girls responded less than similar SES boys, but the gap narrows as paternal education increases.[14] Similar patterns are found when mother's education is the measure of SES (column 3); however, the estimates are less precisely estimated.

This changing student composition along with the deterioration in the quality of primary school inputs (e.g. overcrowding) could combine to alter student achievement. We formally examine the impact of the introduction of FPE on student achievement by estimating Equation (1) with the average test score as the dependent variable. Column 1 of Table 7 shows that the programme had no statistically significant effect on KCPE scores. Examining the test scores by subject, we find that FPE led to a relative deterioration of girls' scores in English and mathematics but improved scores in science, the subject with the highest score gap pre-FPE (columns 2–6). Only in the case of English does the score decline represent an overall decrease in girls' subject scores.

In Table 8 we disaggregate the data to the school level and include interaction terms by school type (private or government). For this analysis, the unit of observation is a school–year–gender, and we add the appropriate triple interaction terms to Equation (1).[15] Column 1 contains the estimates of the effect of the programme on the number of graduates. We cannot reject that the number of girls graduating from both types of schools did not change. The number of male graduates from government schools did increase, and relative to boys, fewer girls responded to FPE in both government and private schools. For the girls in government schools, FPE resulted in a widening of the achievement gap by 1% of a standard deviation in a district of average intensity (column 2), a small change relative to the pre-program achievement gap of 25% of a standard deviation. We fail to reject (p-value $= 0.13$) that the average female score changed in absolute terms.

In Kenya, newspapers report the top schools by KCPE score. If parents value educational quality differently for children of different genders, then FPE could induce differential responses by gender for schools of different quality. We divide schools into three categories within a district based on their pre-programme KCPE scores: top, 10%; middle, 80%;

[14] When paternal education is 9.44 years, the responses of boys and girls are expected to be equal.

[15] Because the categorisation of a school as government or private is mutually exclusive and completely exhaustive, we cannot include 'intensity' as an additional regressor.

Table 7: Effect of FPE on Achievement

Dependent variable	Standardised KCPE score	Standardised subject scores				
		English	Swahili	Mathematics	Science	Social studies
	(1)	(2)	(3)	(4)	(5)	(6)
Intensity	−0.048 (0.034)	−0.034 (0.030)	−0.035 (0.043)	−0.018 (0.026)	−0.051 (0.037)	−0.031 (0.043)
Intensity × female	−0.0002 (0.005)	−0.0169*** (0.005)	−0.004 (0.006)	−0.0104* (0.006)	0.0176*** (0.005)	0.009 (0.006)
Female	−0.260*** (0.013)	0.021 (0.015)	0.0367*** (0.013)	−0.297*** (0.012)	−0.469*** (0.010)	−0.400*** (0.016)
Coefficients on intensity + intensity × female = 0						
F-stat	2.09	3.29	0.84	1.13	0.87	0.27
p-value	0.15	0.07	0.36	0.29	0.36	0.61
Observations	1,104	1,104	1,104	1,104	1,104	1,104
R^2	0.91	0.89	0.95	0.93	0.93	0.90

Notes: Standard errors clustered at the district level appear in parentheses. All regressions include district time trends and district and year dummy variables. The unit of observation is a district-year-gender. The composite KCPE score is the average of the scores on the five subject examinations. Column 6: known in Kenya as GHCR (geography, history, civics and religion).
*Significant at 10%.
**Significant at 5%.
***Significant at 1%.

Table 8: Effect of FPE on Sorting Across School Types by Gender

Dependent variable	Number of primary school graduates (1)	Standardised KCPE score (2)
Intensity × government school	2.026*** (0.544)	−0.043 (0.036)
Intensity × private school	0.911 (0.772)	0.017 (0.039)
Intensity × government School × female	−1.461*** (0.22)	−0.0114** (0.01)
Intensity × private school × female	−0.886*** (0.22)	−0.014 (0.02)
Government school × female	0.744** (0.33)	−0.0113 (0.01)
Private school × female	0.0203*** (0.01)	0.00113*** (0.00)
Government school	7.617*** (1.9)	−0.670*** (0.1)
Coefficients on intensity × government school + intensity × government school × female = 0		
F-stat	1.21	2.35
p-value	0.28	0.13
Observations	276,414	276,414
R^2	0.21	0.28

Notes: Standard errors clustered at the district level appear in parentheses. All regressions include district time trends and district, year and government school dummy variables. The unit of observation is a school–year–gender.
*Significant at 10%.
**Significant at 5%.
***Significant at 1%.

bottom, 10%. Table 9 contains the estimates of Equation (1) with interaction terms that separate schools by pre-programme school quality.[16] For a given level of effective intensity, the average number of graduates in the top schools increased the most, consistent with anecdotal evidence about overcrowding in pre-FPE top schools. The average number of girls graduating from these top schools increased, but by a smaller magnitude than the increase in the number of boys. Column 2 contains the estimates for the average scores. The average scores declined for both genders in top schools, more so for girls, and average scores increased for both genders in the bottom schools, but less so for girls.

We explore some of the potential mechanisms that could cause the relationships we have uncovered. Our results have consistently shown that girls respond less to FPE than boys. As outlined above, the differential

[16] Because the categorisation of a school as being in the top 10%, the middle 80% or the bottom 10% is mutually exclusive and completely exhaustive, we cannot include 'intensity' as an additional regressor.

Table 9: The Effect of FPE on Sorting Across School Quality by Gender

Dependent variable	Number of primary school graduates (1)	Standardised KCPE score (2)
Intensity × school in top 10%	4.304*** (0.612)	−0.181*** (0.040)
Intensity × school in middle 80%	1.839*** (0.512)	−0.045 (0.036)
Intensity × school in bottom 10%	1.241** (0.59)	0.103*** (0.04)
Intensity × school in top 10% × female	−1.312*** (0.26)	0.0102* (0.01)
Intensity × school in middle 80% × female	−1.269*** (0.21)	−0.00268 (0.005)
Intensity × school in bottom 10% × female	−1.459*** (0.17)	−0.0213*** (0.01)
School in top 10% × female	−0.939*** (0.35)	−0.251*** (0.01)
School in middle 80% × female	−0.540* (0.31)	−0.252*** (0.01)
School in bottom 10% × female	−0.257 (0.27)	−0.228*** (0.01)
Coefficients on intensity × school in top 10% + intensity × school in top 10% × female = 0		
F-stat	23.16	17.52
p-value	0.00	0.00
Observations	276,414	276,414
R^2	0.22	0.42

Notes: Standard errors clustered at the district level appear in parentheses. All regressions include district time trends and district, year and government school dummy variables. The unit of observation is a school–year–gender. School quality is determined by pre-FPE KCPE scores. Top 10%, middle 80% and bottom 10% are dummy variables equal to 1 if the school was in the stated place in the pre-FPE score distribution.
*Significant at 10%.
**Significant at 5%.
***Significant at 1%.

investment in education could reflect gender differences in the returns to education. This suggests that investments in girls' schooling should be greater in areas where the (relative) returns to education for girls is higher. We explore this hypothesis in Table 10. Due to the lack of sufficient wage data at the district level, we construct a proxy measure of gender-specific labour market returns using the 1999 census. For each district, we calculate the ratio of the probability of formal employment for those who completed primary school relative to the probability of formal employment for those who did not complete primary school, and use this as a proxy measure for labour market returns to primary education. We also compute gender-specific returns for each district in a similar fashion and the ratio of male-to-female returns. A district has a 'high return' if that district's value is larger than the median district's. We then use this

Table 10: Heterogeneous Effects of FPE by Labour Market Differences

Dependent variable	Number of primary school graduates (1)	Standardised KCPE score (2)	Number of primary school graduates (3)	Standardised KCPE score (4)	Number of primary school graduates (5)	Standardised KCPE score (6)
Intensity	480.1* (240.8)	−0.010 (0.091)	537.5** (219.5)	−0.028 (0.087)	415.9*** (121.3)	−0.049 (0.036)
Intensity × female	−289.6*** (49.18)	0.0166** (0.0077)	−299.5*** (49.86)	0.0141* (0.0073)	−159.5*** (45.16)	0.001 (0.0064)
Intensity × high return to primary school	−62.05 (198.9)	−0.0356 (0.0677)				
Intensity × high return to primary school × female	141.3* (70.88)	−0.00858 (0.0096)				
High return to primary school × female	−745.4*** (122.7)	−0.0951*** (0.0222)				
Intensity × high female return to primary school			−105.4 (184.8)	−0.0193 (0.0643)		
Intensity × high female return to primary school × female			135.0* (74.49)	−0.00934 (0.010)		
High female return to primary school × female			−671.5*** (129.40)	−0.0809*** (0.02)		
Intensity × high relative male return to primary school					32.40 (164.4)	−0.0115 (0.061)
Intensity × High relative male return to primary school × female					−247.7** (119.0)	0.007 (0.011)
High relative male return to primary school × sfemale					396.4*** (139.3)	0.0446* (0.025)
Observations	1,104	1,104	1,104	1,104	1,104	1,104
R^2	0.99	0.92	0.99	0.92	0.99	0.91

Notes: Standard errors clustered at the district level appear in parentheses. The unit of observation is a district–year–gender. All regressions include district time trends and district, year and female dummy variables. All 'High' variables are district-level dummy variables equal to 1 if the district's relevant value is above the countrywide median. Return to Primary School is the ratio of the probability of being employed for pay for primary school graduates relative to the same probability for non-graduates. Female Return is calculated similarly based on female employment only. Relative Male Return is the ratio of the male return to the female return. All returns to education calculated from the 1999 Kenyan Census.

*Significant at 10%.

**Significant at 5%.

***Significant at 1%.

indicator of labour market return in a triple difference specification.[17] Columns 1, 3 and 5 of Table 10 show that the increase in the number of female graduates was larger in areas with higher overall returns to education (column 1), higher female returns (column 3) and higher relative female returns (column 5). However, the gender gaps in test scores do not change with the relative economic returns to education (columns 2, 4 and 6). Overall, these results are consistent with prior findings, such as Rosenzweig and Schultz (1982), that showed that gender differentials in intra-household allocations of resources (e.g. education) are responsive to the gender differences in economic returns.

We also explore the potential for a differential impact by the pre-FPE prevalence of early marriage and pregnancy. From the 1999 census, we calculate for each district the percentage of 16-year-old girls who were married and the percent who had at least one child. We use each of these measures separately in a triple interaction approach similar to Table 10. Somewhat surprisingly, we do not find any statistically significant relationship between the prevalence of early marriage in a district and the gender differences in the number of graduates (results not shown). Thus, the number of girls who respond to FPE does not vary with the prevalence of early marriage or child bearing.

7. Additional considerations and robustness

Our identification strategy relies on spatial and temporal variation in FPE intensity. Any effects of FPE that are uniform across the country (e.g. a change in accountability because fees come from the government instead of parents) cannot be separated from other nationwide changes and are controlled for with year-fixed effects. These changes could be important considerations in calculating a total effect of FPE, but unfortunately they cannot be identified.

There are a number of potential threats to our identification strategy. In Tables 11 and 12 we provide additional specifications to test these threats. In both tables, we repeat our baseline findings in columns 1 and 2 to ease comparisons. In addition to FPE, the newly elected government provided

[17] Because selection into formal employment might be differential by ability, and the likely positive correlation between ability and primary school completion, this ratio may overstate the return to primary schooling. Any uniform selection across the whole country will not affect our results since we use an indicator variable for 'high return' instead of interpreting the cardinal value. As long as any heterogenous selection between districts maintains the ordinal ranking around the median, 'high return' is correctly assigned.

Table 11: Robustness Checks: 1

Dependent variable	Baseline specification		Control for constituency development funds		Control for pre-program district unemployment × year		Control for pre-program school quality			
							Average district score 2000–2002 × year		Percentage with less than grade 1 × year	
	Number of graduates (1)	Standardised KCPE score (2)	Number of graduates (3)	Standardised KCPE score (4)	Number of graduates (5)	Standardised KCPE score (6)	Number of graduates (7)	Standardised KCPE score (8)	Number of graduates (9)	Standardised KCPE score (10)
Panel A: all schools combined										
Intensity	471.6***	−0.048	503.4***	−0.033	402.2**	−0.028	529.8***	−0.015	366.2***	−0.065
	(125.8)	(0.034)	(134.7)	(0.035)	(163.2)	(0.039)	(158.1)	(0.037)	(114.5)	(0.045)
Intensity × female	−253.0***	−0.0002	−292.9***	−0.0134**	−273.5**	−0.0467***	−369.3**	−0.0612***	−235.6***	−0.0058
	(50.52)	(0.005)	(83.03)	(0.007)	(132.80)	(0.013)	(151.10)	(0.019)	(67.53)	(0.006)
Observations	1,104	1,104	1,024	1,024	1,104	1,104	1,104	1,104	1,104	1,104
R^2	0.985	0.912	0.984	0.914	0.985	0.918	0.985	0.923	0.986	0.924
Panel B: schools differentiated by type										
Intensity × government school	2.026***	−0.043	2.044***	−0.034	2.397***	−0.011	2.800***	0.001	1.635***	−0.023
	(0.54)	(0.036)	(0.535)	(0.035)	(0.635)	(0.039)	(0.623)	(0.037)	(0.544)	(0.037)
Intensity × private school	0.911	0.0174	0.854	0.022	1.203	0.052	1.674**	0.059	0.456	0.034
	(0.77)	(0.039)	(0.797)	(0.038)	(0.870)	(0.043)	(0.832)	(0.039)	(0.767)	(0.039)
Intensity × government school × female	−1.461***	−0.0114**	−1.801***	−0.0288***	−2.116***	−0.0639***	−2.898***	−0.0892***	−0.909***	−0.00674
	(0.22)	(0.005)	(0.34)	(0.008)	(0.55)	(0.014)	(0.62)	(0.018)	(0.30)	(0.007)
Intensity × private school × female	−0.886***	−0.0140	−1.009***	−0.0161*	−1.410***	−0.0700***	−2.329***	−0.0863***	−0.22	−0.00174
	(0.22)	(0.015)	(0.32)	(0.009)	(0.51)	(0.017)	(0.55)	(0.019)	(0.26)	(0.010)
Observations	276,414	276,414	272,536	272,536	276,414	276,414	276,414	276,414	276,414	276,414
R^2	0.21	0.28	0.22	0.28	0.21	0.28	0.21	0.28	0.22	0.28
Panel C: schools differentiated by quality										
Intensity × school in top 10%	4.304***	−0.181***	4.420***	−0.171***	4.717***	−0.146***	5.113***	−0.135***	3.931***	−0.159***
	(0.612)	(0.040)	(0.576)	(0.039)	(0.726)	(0.042)	(0.723)	(0.039)	(0.637)	(0.040)
Intensity × school in middle 80%	1.839***	−0.045	1.828***	−0.0351	2.230***	−0.0113	2.623***	−0.0006	1.442***	−0.0230
	(0.512)	(0.036)	(0.507)	(0.035)	(0.620)	(0.039)	(0.605)	(0.036)	(0.517)	(0.037)
Intensity × school in bottom 10%	1.241**	0.103***	1.277**	0.112***	1.645**	0.137***	2.046***	0.149***	0.860	0.125***
	(0.585)	(0.038)	(0.612)	(0.037)	(0.672)	(0.041)	(0.641)	(0.040)	(0.604)	(0.039)

Intensity × school in top 10% × female	−1.312***	0.0102*	−1.831***	−0.0146	−2.159***	−0.0531***	−2.932***	−0.0795***	−0.920**	0.0077
	(0.262)	(0.006)	(0.415)	(0.009)	(0.591)	(0.014)	(0.646)	(0.019)	(0.381)	(0.008)
Intensity × school in middle 80% × female	−1.269***	−0.003	−1.686***	−0.0258***	−2.076***	−0.0641***	−2.843***	−0.0889***	−0.832***	−0.0046
	(0.207)	(0.005)	(0.328)	(0.008)	(0.547)	(0.014)	(0.615)	(0.019)	(0.291)	(0.0069)
Intensity × school in bottom 10% × female	−1.459***	−0.0213***	−1.952***	−0.0451***	−2.294***	−0.0837***	−3.077***	−0.110***	−1.049***	−0.0234**
	(0.170)	(0.008)	(0.277)	(0.011)	(0.496)	(0.017)	(0.545)	(0.022)	(0.273)	(0.009)
Observations	276,414	276,414	272,536	272,536	276,414	276,414	276,414	276,414	276,414	276,414
R^2	0.22	0.42	0.22	0.43	0.22	0.42	0.22	0.43	0.23	0.42
Panel D: return to primary school										
Intensity	480.1*	−0.010	553.8**	0.0067	398.7*	0.0034	434.60	0.109	474.6*	0.0278
	(240.8)	(0.091)	(237.2)	(0.096)	(234.7)	(0.098)	(276.4)	(0.074)	(240.4)	(0.067)
Intensity × female	−289.6***	0.0166**	−289.6***	0.0063	−160.9	−0.0238	−233.90	−0.0593**	−276.0***	0.0144*
	(49.18)	(0.008)	(63.5)	(0.009)	(125.5)	(0.018)	(180.8)	(0.028)	(50.9)	(0.008)
Intensity × high return to primary school	−62.050	−0.036	−117.9	−0.0387	−92.74	−0.0402	−33.6	−0.122**	−170.9	−0.0863
	(198.9)	(0.068)	(192.2)	(0.073)	(197.3)	(0.068)	(195.3)	(0.055)	(204.3)	(0.053)
Intensity × high return to primary school × female	141.3*	−0.009	144.1**	−0.0101	92.870	0.0054	115.2	0.0254*	179.5**	−0.0168
	(70.88)	(0.010)	(70.95)	(0.009)	(71.4)	(0.011)	(81.16)	(0.015)	(79.76)	(0.010)
High return to primary school × female	−745.4***	−0.0951***	−748.7***	−0.0654***	−720.6***	−0.0961***	−760.3***	−0.0933***	−798.4***	−0.0685***
	(122.7)	(0.022)	(135.3)	(0.023)	(129.3)	(0.023)	(130.8)	(0.023)	(170.0)	(0.024)
Observations	1,104	1,104	1,024	1,024	1,104	1,104	1,104	1,104	1,104	1,104
R^2	0.99	0.92	0.99	0.92	0.99	0.92	0.99	0.93	0.99	0.93
Panel E: female return to primary school										
Intensity	537.5**	−0.028	608.1***	−0.0148	433.2**	−0.0093	550.2**	0.0809	538.2**	0.0076
	(219.5)	(0.0865)	(218.1)	(0.088)	(211.2)	(0.097)	(249.9)	(0.070)	(217.3)	(0.064)
Intensity × female	−299.5***	0.0141*	−313.8***	0.0024	−207.70	−0.0336*	−344.9*	−0.0690***	−288.6***	0.0116
	(49.86)	(0.0073)	(66.7)	(0.009)	(132.4)	(0.019)	(175.2)	(0.026)	(51.7)	(0.008)
Intensity × high female return to primary school	−105.4	−0.0193	−152.3	−0.0184	−104.7	−0.0264	−105.3	−0.0949*	−220.4	−0.0674
	(184.8)	(0.0643)	(181.2)	(0.067)	(175.1)	(0.067)	(179.1)	(0.052)	(189.3)	(0.052)
Intensity × High female return to primary school × female	135.0*	−0.0093	135.8*	−0.0102	96.170	0.0083	153.0*	0.0270**	167.2*	−0.0186*
	(74.49)	(0.0097)	(75.13)	(0.009)	(74.96)	(0.012)	(80.83)	(0.013)	(86.37)	(0.011)
High female return to primary school × female	−671.5***	−0.0809***	−656.6***	−0.0521**	−649.4***	−0.0834***	−678.3***	−0.0815***	−695.1***	−0.0497*
	(129.4)	(0.0234)	(142.3)	(0.023)	(130.5)	(0.023)	(134.7)	(0.023)	(178.0)	(0.026)
Observations	1,104	1,104	1,024	1,024	1,104	1,104	1,104	1,104	1,104	1,104
R^2	0.99	0.92	0.99	0.92	0.99	0.92	0.99	0.93	0.99	0.93

(*continued on next page*)

Table 11: *Continued*

Dependent variable	Baseline specification		Control for constituency development funds		Control for pre-program district unemployment × year		Control for pre-program school quality			
							Average district score 2000–2002 × year		Percentage with less than grade 1 × year	
	Number of graduates (1)	Standardised KCPE score (2)	Number of graduates (3)	Standardised KCPE score (4)	Number of graduates (5)	Standardised KCPE score (6)	Number of graduates (7)	Standardised KCPE score (8)	Number of graduates (9)	Standardised KCPE score (10)
Panel F: differential return to primary school										
Intensity	415.9***	−0.0491	454.1***	−0.0319	355.9**	−0.0346	494.3***	−0.0143	310.1***	−0.0634
	(121.3)	(0.036)	(129.9)	(0.037)	(150.4)	(0.043)	(150.3)	(0.037)	(111.9)	(0.045)
Intensity × female	−159.5***	0.0013	−211.6***	−0.0130	−201.0	−0.0364***	−320.2**	−0.0547***	−133.1**	−0.0082
	(45.16)	(0.006)	(75.6)	(0.009)	(128.6)	(0.014)	(151.5)	(0.018)	(60.5)	(0.007)
Intensity × high female return to primary school	32.4	−0.0115	8.678	0.0093	40.01	−0.0079	64.73	0.0535	64.79	0.0014
	(164.4)	(0.061)	(171.0)	(0.067)	(160.8)	(0.065)	(156.6)	(0.047)	(167.5)	(0.065)
Intensity × high female return to primary school × female	−247.7**	0.0067	−196.9	0.0102	−267.9*	−0.0135	−351.3**	−0.0294**	−253.3**	0.0125
	(119.0)	(0.011)	(122.50)	(0.010)	(156.30)	(0.013)	(166.90)	(0.014)	(118.70)	(0.010)
High female return to primary school × female	396.4***	0.0446*	348.2**	0.020	390.8***	0.0487*	405.0***	0.0430*	324.5**	0.016
	(139.3)	(0.025)	(167.9)	(0.024)	(133.8)	(0.025)	(148.8)	(0.024)	(146.5)	(0.024)
Observations	1,104	1,104	1,024	1,024	1,104	1,104	1,104	1,104	1,104	1,104
R^2	0.99	0.91	0.99	0.91	0.99	0.92	0.99	0.92	0.99	0.92

Notes: Standard errors clustered at the district level appear in parentheses. All regressions include district time trends and district, year, and female dummy variables. Panels B and C include urban, boarding and government school dummy variables. Panel A: column 1 from Table 3 column 1, column 2 from Table 6 column 1. Panel B: columns 1 and 2 from Table 7 columns 1 and 2. Panel C: columns 1 and 2 from Table 8 columns 1 and 2. Panel D: columns 1 and 2 from Table 9 columns 1 and 2. Panel E: columns 1 and 2 from Table 9 columns 3 and 4. Panel F: columns 1 and 2 from Table 9 columns 5 and 6. Columns 3 and 4: additional controls of poverty from the 1997 WMS times year and times female times year. Columns 5 and 6: additional controls of district level unemployment from the 1999 Kenyan census times year and times female times year. Columns 7 and 8: additional controls of pre-FPE district KCPE score times year and times female times year. Columns 9 and 10: additional controls of the percentage of individuals who did not complete grade 1 from the 1999 Kenya Census times year and times female times year. See text for additional explanation.

*Significant at 10%.

**Significant at 5%.

***Significant at 1%.

Table 12: Robustness Checks: 2

Dependent variable	Baseline specification		Control for district × post		Control for province × year	
	Number of graduates (1)	Standardised KCPE score (2)	Number of graduates (3)	Standardised KCPE score (4)	Number of graduates (5)	Standardised KCPE score (6)
Panel A: government and private schools combined						
Intensity	471.6*** (125.8)	−0.048 (0.034)	356.3*** (128.3)	−0.055 (0.041)	512.3*** (154.8)	−0.0237 (0.033)
Intensity × female	−253.0*** (50.52)	−0.0002 (0.005)	−117.8*** (36.80)	0.0256*** (0.009)	−320.0*** (112.60)	−0.0385*** (0.0130)
Observations	1,104	1,104	1,104	1,104	1,104	1,104
R^2	0.985	0.912	0.992	0.937	0.985	0.918
Panel B: schools differentiated by type						
Intensity × government school	2.026*** (0.54)	−0.0433 (0.04)	1.175** (0.55)	−0.0572* (0.034)	2.646*** (0.60)	−0.025 (0.034)
Intensity × private school	0.911 (0.77)	0.0174 (0.04)	0.099 (0.80)	0.006 (0.035)	1.366 (0.86)	0.028 (0.037)
Intensity × government school × female	−1.461*** (0.22)	−0.0114** (0.01)	−0.406** (0.17)	0.0251*** (0.01)	−2.437*** (0.53)	−0.0588*** (0.01)
Intensity × private school × female	−0.886*** (0.22)	−0.0140 (0.02)	0.0969 (0.27)	0.0168*** (0.006)	−1.561*** (0.45)	−0.0438*** (0.012)
Observations	276,414	276,414	276,414	276,414	276,414	276,414
R^2	0.21	0.28	0.22	0.29	0.21	0.28
Panel C: schools differentiated by quality						
Intensity × school in top 10%	4.304*** (0.612)	−0.181*** (0.040)	3.449*** (0.621)	−0.196*** (0.037)	4.917*** (0.676)	−0.161*** (0.038)
Intensity × school in middle 80%	1.839*** (0.512)	−0.045 (0.036)	0.990* (0.534)	−0.0596* (0.033)	2.437*** (0.581)	−0.0258 (0.034)
Intensity × school in bottom 10%	1.241** (0.585)	0.103*** (0.038)	0.37 (0.602)	0.0878** (0.037)	1.847*** (0.634)	0.122*** (0.036)
Intensity × school in top 10% × female	−1.312*** (0.262)	0.0102* (0.006)	−0.39 (0.267)	0.0398*** (0.012)	−2.402*** (0.590)	−0.0456*** (0.013)
Intensity × school in middle 80% × female	−1.269*** (0.207)	−0.003 (0.005)	−0.346* (0.174)	0.0261*** (0.009)	−2.329*** (0.522)	−0.0564*** (0.012)
Intensity × school in bottom 10% × female	−1.459*** (0.170)	−0.0213*** (0.008)	−0.488** (0.203)	0.01 (0.011)	−2.537*** (0.465)	−0.0760*** (0.016)
Observations	276,414	276,414	276,414	276,414	276,414	276,414
R^2	0.22	0.42	0.23	0.43	0.22	0.43
Panel D: return to primary school						
Intensity	480.1* (240.8)	−0.010 (0.091)	601.8* (304.2)	−0.0408 (0.118)	457.4* (244.4)	0.0109 (0.091)
Intensity × female	−289.6*** (49.18)	0.0166** (0.008)	−200.0*** (74.0)	0.0434*** (0.013)	−241.1** (106.0)	−0.0159 (0.017)
Intensity × high return to primary school	−62.050 (198.9)	−0.036 (0.068)	−218.4 (225.2)	−0.0053 (0.084)	−38.5 (196.6)	−0.0411 (0.066)
Intensity × high return to primary school × female	141.3* (70.88)	−0.009 (0.010)	94.610 (79.39)	−0.0276* (0.014)	104.000 (63.54)	0.0021 (0.012)

(*continued on next page*)

Table 12: *Continued*

Dependent variable	Baseline specification		Control for district × post		Control for province × year	
	Number of graduates (1)	Standardised KCPE score (2)	Number of graduates (3)	Standardised KCPE score (4)	Number of graduates (5)	Standardised KCPE score (6)
High return to primary school × female	−745.4*** (122.70)	−0.0951*** (0.022)	−682.3*** (132.1)	−0.0911*** (0.023)	−698.5*** (128.0)	−0.0895*** (0.022)
Observations	1,104	1,104	1,104	1,104	1,104	1,104
R^2	0.99	0.92	0.99	0.94	0.99	0.92
Panel E: female return to primary school						
Intensity	537.5** (219.5)	−0.028 (0.087)	623.5** (271.2)	−0.0582 (0.110)	535.7** (223.7)	−0.0025 (0.086)
Intensity × female	−299.5*** (49.86)	0.0141* (0.007)	−182.0** (73.6)	0.0437*** (0.013)	−293.9*** (109.5)	−0.0227 (0.017)
Intensity × high female return to primary school	−105.4 (184.8)	−0.019 (0.064)	−238.0 (202.5)	0.0094 (0.079)	−88.4 (180.1)	−0.0265 (0.063)
Intensity × high female return to primary school × female	135.0* (74.49)	−0.009 (0.010)	73.320 (79.29)	−0.0283* (0.014)	112.0* (66.64)	0.0014 (0.011)
High female return to primary school × female	−671.5*** (129.4)	−0.0809*** (0.023)	−604.8*** (139.3)	−0.0794*** (0.024)	−616.7*** (138.9)	−0.0741*** (0.023)
Observations	1,104	1,104	1,104	1,104	1,104	1,104
R^2	0.99	0.92	0.99	0.94	0.99	0.92
Panel F: differential return to primary school						
Intensity	415.9*** (121.3)	−0.049 (0.036)	345.6*** (129.5)	−0.0523 (0.045)	466.9*** (143.4)	−0.0290 (0.036)
Intensity × female	−159.5*** (45.16)	0.001 (0.006)	−96.23*** (23.2)	0.0151** (0.006)	−247.3** (103.0)	−0.0296** (0.013)
Intensity × high female return to primary school	32.4 (164.4)	−0.012 (0.061)	44.340 (165.4)	−0.0381 (0.073)	49.490 (162.9)	−0.0044 (0.060)
Intensity × High Female return to primary school × female	−247.7** (119.00)	0.007 (0.011)	−87.9 (97.36)	0.0297* (0.016)	−282.8* (143.50)	−0.0098 (0.013)
High female return to primary school × female	396.4*** (139.3)	0.0446* (0.025)	317.5** (155.8)	0.0456* (0.026)	385.1*** (136.7)	0.0457* (0.024)
Observations	1,104	1,104	1,104	1,104	1,104	1,104
R^2	0.99	0.91	0.99	0.94	0.99	0.92

Notes: Standard errors clustered at the district level appear in parentheses. All regressions include district time trends and district, year, and female dummy variables. Panels B and C include urban, boarding and Government school dummy variables. Columns 1 and 2: See notes for Table 11. Columns 3 and 4: additional controls of district times post and times female times post. Columns 5 and 6: additional controls of province times year and times female times year. See text for additional explanation.

*Significant at 10%.

**Significant at 5%.

***Significant at 1%.

Constituency Development Funds to districts based on their poverty levels calculated using the 1997 WMS data. Using the same WMS data, we interact the poverty level in 1997 with year dummy variables and year dummy variables times female to control for this programme. Our results are robust to this inclusion (Table 11, columns 3 and 4). One might worry about other minor programmes that targeted districts with low levels of formal employment. We interact the district unemployment rate for all individuals aged 15–64 calculated from the 1999 Census with year dummy variables and year dummy variables times female and include these regressors as additional controls (columns 5 and 6). Our findings are robust to these inclusions. An additional concern with our strategy is that our intensity measure might capture the quality of schools. To control for this possibility, we interact two separate measures of school quality with year dummy variables and year dummy variables times female as additional controls. In columns 7 and 8 we use the average KCPE score for a district before FPE in the interactions and in columns 9 and 10 we include interactions for the percentage of 18–20 year olds who did not complete standard 1, an alternative measure of the quality of school. Our findings are robust to both of these additional covariates. Table 12 contains additional robustness checks. Because our intensity measure is assigned at the district–year level, we cannot include district times year effects. Instead we include district times post and district times post times female interactions in columns 3 and 4 to control for other potential changes in a district that occurred in the first year of the new government. In columns 5 and 6 we include interactions of province times year and province times year times female to account for any regional political power shifts (due to the 2002 elections) that may be correlated with intensity. Our results remain robust.

8. Conclusions

The FPE programme in Kenya was implemented at the start of the 2003 school year and eliminated school fees in all government schools. Prior to the programme, 95 girls per 100 boys completed primary school. While the programme was successful in increasing the number of students of both genders who completed primary school, our results show that it widened the gender gap in completion. Although the programme increased overall completion, especially among boys from lower socioeconomic

households and girls from districts with higher returns to female schooling, the programme had no effect on the (overall) gender gap in achievement.

Our results are in contrast to prior studies in Uganda that have generally found that female enrolment responds more than male enrolment to free education programmes. Our study differs due to our focus on primary school completion, by which time girls are older and more likely to have dropped out of school due to marriage and pregnancy, rather than enrolment.

Due to data limitations, our results provide only the short-run impacts of the FPE programme on gender gaps in primary school completion and achievement. While the results on the reductions of delayed entry provide some hope that the long-run effect of FPE may differ due to the reduction in delayed primary school entry of girls, the 2010 primary school completion statistics showed that gender gaps have yet to narrow (KNEC 2010). Overall, our results suggest that FPE programmes are insufficient to narrow the gender gap in primary school completion or achievement. Thus additional programmes such as conditional cash transfers or the provision of school uniforms may be necessary to close gender gaps in primary education in order to successfully meet the goals of universal primary education.

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