The Effect of Treatment on the Untreated: Free Primary Education in Kenya

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1 Introduction

How does expansion of access to education affect students that would have enrolled in the absence of the expansion? Expanding access to education allows previously constrained children to enroll in school, potentially changing the composition of students, increasing the size of the student body and class pupil-teacher ratios. Such changes may affect the outcomes of students that would have enrolled in the absence of the policy change. This paper uses the Free Primary Education (FPE) program in Kenya to examine the long-term impact of the elimination of public school fees on the educational attainment and literacy rates of students.

The Kenyan government introduced its Free Primary Education (FPE) program in January 2003, eliminating all fees for public primary schools. The FPE program is likely to affect students differently based on their ease of access to primary education pre-policy. If the FPE program increases the number of economically disadvantaged students enrolled in primary school, it may change the composition of public school classes. Changes to pupil-teacher ratio and the composition of students may affect the learning outcomes of students that would have otherwise been enrolled. Changes to the classroom environment may lead to richer or higher-ability students moving towards private schools, or of withdrawing from formal education entirely.

I estimate the impacts of Kenya's FPE program on educational attainment and literacy rates for different ethnic groups. I use cohort variation in exposure to the policy to estimate the impact of a year of exposure to the FPE program, and I use an individual's ethnicity to proxy for his likelihood of being a student in the absence of the FPE program. I find that for individuals belonging ethnic groups that were relatively unaffected by the policy (that is, groups with relatively high access to primary education before the policy change), exposure to the policy has no significant bearing on educational attainment or likelihood of literacy. This finding suggests that exposure to the FPE does not significantly affect achievement for students that would have enrolled in the absence of the policy, or that the effects are not drastic enough to affect literacy rates. For individuals with relatively low pre-program enrollment rates, I find

that exposure to the FPE program significantly and substantially increases educational attainment and literacy rates.

My findings are consistent with the findings of other research on free primary education programs in sub-Saharan Africa which show increased enrollment particularly among poorer children (Grogan, 2009; Lucas and Mbiti, 2012). Much of the literature examining the effects of FPE programs employs difference-in-differences designs, exploiting variation in intensity of treatment; however, individuals with low expected intensity of treatment may be affected by the policy in ways that differ from the ways in which individuals with high expected intensity of treatment are affected. Instead, I estimate the effect of a year of exposure to the policy relative to the within-group pre-policy trend. My research design allows me to estimate the effect of policy exposure on the educational attainment and literacy of students with high pre-policy enrollment rates. Whether such students are affected by the policy or not is of inherent interest, and is also of interest with respect to the existing literature. To the extent that children whose access to education is not significantly affected by the FPE policy experience learning effects due to the policy, difference-in-difference estimates based on comparisons between groups with different intensities of treatment may be biased. My findings suggest that there were no significant learning effects on such students, though I cannot rule out the possibility of within-group heterogeneous policy effects.

The paper proceeds as follows. Section 2 discusses the Kenyan education system; Section 3 reviews the relevant literature; Section 4 describes my empirical strategy; Section 5 describes the data I use; Section 6 describes the results of my analysis; Section 7 concludes.

2 Background

Primary school in Kenya spans 8 years, from grade 1 to grade 8. Students may enroll in grade 1 if they are at least 6 years old at the beginning of the school year. Prior to the implementation of the FPE program, public and private primary schools charged fees. On average, public school fees were approximately US$16 per year in 1997 (The World Bank, 2004), but some schools charged up to US$350 per year (Lucas and Mbiti, 2012). Fees were collected to pay for tuition, supplies, books, and facilities maintenance. After the introduction of the FPE policy, public primary schools received approximately US$14 per pupil per year from the government and parents of primary-age students faced no enrollment cost.

The FPE policy appeared to have an immediate impact, with total primary school enrollment jumping from 6.3 million in 2002 to 7.2 million in 2004 (The World Bank, 2004). The Kenyan government provided extra funding to primary schools to support the expected influx of students, providing 1020 Kenyan Shillings per pupil. Some research has suggested, however, that the classroom environment deteriorated in the form of higher pupil-teacher ratios and less targeted teaching methods in the years following the implementation of the FPE policy (Majanga, Nasongo and Sylvia, 2011).

High rates of grade repetition and dropout persisted in the Kenyan education system prior to the implementation of the FPE policy (The World Bank, 2004). The Kenyan education system also featured significant disparities across groups, particularly along regional lines.

If infrastructure and staffing investments are not made by school administrators, average class sizes will increase with total enrollment after an access expansion. Class size is a well-known input to student achievement and teaching effectiveness. Hoxby (2000) exploits exogenous variation in primary school class sizes in the United States and finds no significant effect on student achievement. However, if increased class sizes are accompanied by a more heterogeneous classroom distribution of student abilities, instructors will be less able to target classroom instruction effectively, and student achievement will suffer (Duflo, Dupas and Kremer, 2011). Bosworth (2014) demonstrates that class size reductions affect heterogeneous North Carolinian fourth- and fifth-graders differentially. In particular, the authors find that low-ability students benefit from class size reductions while high-ability students are relatively unaffected, and smaller classes tend to have smaller achievement gaps. Majanga, Nasongo and Sylvia (2011) documents increases in class size and pupil-teacher ratios in the wake of the implementation of Kenya's FPE policy in the Nakuru Municipality, and observed an increase in lecture-style teaching, particularly in lower classes. Lucas and Mbiti (2012) documents increases in class size following the adoption of FPE; Sanders (2007) describes the rapid and extreme increase in student population at Olympic Primary School in Nairobi, where average class size reached a level nearly double its pre-FPE level by 2007. These factors may differentially affect students of different backgrounds.

The change in the composition of primary students brought about by the introduction of Kenya's FPE program seems likely to be detrimental to students that would have enrolled in primary school in the absence of the program, to the extent that they remain in public schools. Students that enroll as a result of the program introduction seem likely to come from relatively low-income and low-education households, and likely to perform less well than the pre-FPE average. Lucas and Mbiti (2012) finds that public school students' parents are significantly less literate on average after the introduction of the FPE program in Kenya. Further, high-ability or richer students may choose to enroll in private schools instead of public schools after the policy change (Hsieh and Urquiola, 2006). Lucas and Mbiti (2012) also show that the FPE program significantly increased the number of students per teacher in Kenyan primary classrooms. This will negatively affect achievement among low-ability students that would have enrolled in the absence of the policy, but if new students lower the class average student ability, teachers may target instruction nearer to low-ability student levels. If high-ability students do flee to private schools, the distribution will further shift towards the low-ability students. That is, the increase in class sizes may not negatively affect the achievement of low-ability students that would have enrolled in the absence of the policy change. However, the increase in class size seems likely to harm the achievement of middle-ability public primary students that would have enrolled in the absence of the policy change. More affluent students who exit public schooling

have been shown to experience a degree of positive peer effects due to the change in peers (Bold et al., 2011).

3   Literature review

A large literature has found that increasing access to education, especially through free primary education policies, cause increases in enrollment in developing economies. Al-Samarri and Zaman (2007) examines the abolishment of primary school fees in Malawi, finding that the policy led to increases in both primary and secondary school enrollment. The universal primary education (UPE) program in Uganda has been shown to have caused large increases in primary school enrollment, as well as decreased delayed enrollments and increased grade completion rates through fifth grade (Deininger, 2003; Nishimura, Yamano and Sasaoka, 2008). Duflo (2001) examines the effect of a large school construction program in Indonesia on attainment, finding that the program increases average educational attainment significantly. Lucas and Mbiti (2012) examines the Kenyan context specifically, finding that the Kenyan FPE program increased the number of students completing primary school. This paper examines heterogeneity in the program effect by pre-policy likelihood of enrollment.

When a country expands access to education, it expands the set of students that enroll in a given affected grade. Certain groups of students that couldn't or wouldn't previously attend the grade will enroll after the policy change, and this will affect the composition of students. For example, if a given grade becomes free to parents of students, students from lower-income families that were unlikely to have enrolled before the policy change will be more likely to enroll after the policy change due to the lowered cost of enrollment and the average family income of a student in that grade will decrease. Consistent with this hypothesis, Grogan (2009) and Nishimura, Yamano and Sasaoka (2008) find that Uganda's FPE program led to earlier and higher primary enrollment among low-income children. If peer effects exist, the performance of students that would have enrolled in the absence of the policy change will be affected by a changed peer group if the new students perform differently on average. Duflo, Dupas and Kremer (2011) exploit an experiment tracking students by ability to investigate the existence of peer effects among primary school students in Kenya, among other things; the authors find a positive direct effect of high-achieving peers on student achievement. In this paper, I analyze the within-group effect of policy exposure on educational attainment and literature. Among students with high pre-policy enrollment, policy effects could be driven by peer effects. These students are of particular interest to this project.

Research has shown that Kenya's FPE program caused an increase in student entry into private schools, however (Lucas and Mbiti, 2012). The literature suggests that the highest-performing students in Kenya attend private schools, and that some high-performing students exited public schooling after the implementation of FPE in Kenya. Bold et al. (2011) finds that the quality of Kenyan public schools declined after

the implementation of the FPE policy. The authors find that the decline is driven by the exit of affluent students from public schools, and the selection of weaker students into public education. Lucas and Mbiti (2014), in a complementary paper, show evidence that Kenya's most prestigious schools do not add significant value relative to other schools; rather, the schools' reputations are driven by selection. It is possible that children that were likely to have enrolled in public school in the absence of the FPE policy are likely to exit public schooling due to the policy, and not experience significant changes in the compositions of their classrooms.

The research on the effects of universal primary education policies consistently finds increases in enrollment among poor children (Lucas and Mbiti, 2012; Nishimura, Yamano and Sasaoka, 2008; Bold et al., 2011; Deininger, 2003; Al-Samarri and Zaman, 2007). Deininger (2003) also show that the Ugandan UPE program reduced inequality in enrollment along gender and regional lines. Other research has shown that universal primary education reforms have caused increases in educational attainment beyond primary school completion (Osili and Long, 2008; Uwaifo Oyelere, 2010). Some of this research has shown that the Kenya FPE policy led to an increase in enrollment among relatively poor children. It is likely that most public school classrooms experienced a significant change in student composition in the wake of the policy; groups with relatively low pre-policy enrollment rates are likely to be more represented in public schooling as a result of the FPE policy.

I analyze long-term effects of the FPE policy in this paper. Rather than enrollment, I examine educational attainment; I also examine the effect of the policy on literacy rates of women of different ethnicities. A substantial literature has found that universal primary education programs have long-lasting effects. Behrman (2015b) exploits the adoption of UPE in Malawi and Uganda, estimating that an additional year of education reduces the probability of testing positive for HIV as an adult by 0.06 percentage points in Malawi and by 0.03 percentage points in Uganda. In a related paper, Behrman (2015a) shows that increased schooling causes decreases in affected women's ideal family size. Duflo (2001) examines the effects of an Indonesian school construction program on future wages, finding that the program led to increased future wages. Larreguy and Marshall (2017) exploits variation in intensity of exposure to Nigeria's universal primary education reform to analyze the effect of education on political engagement; the authors find that the reform caused increased political engagement, and that the effects are largest among minority groups whose access to education may have been relatively low in the absence of the reform.

4   Empirical strategy

I employ a regression kink design (RKD) to analyze the effect of the FPE policy on educational attainment and literacy rates. The FPE program was implemented in 2003; exposure to the policy varies by cohort. Figure 1 shows the progression of policy exposure by cohort. Women born prior to 1990 were beyond primary school age in 2003, and are not exposed to the policy. Women born in 1990 were 13-14 at the time

of policy implementation, and eligible for grade 8 (the final grade of Kenyan primary school) enrollment; women born in 1991 were 12-13 at the time of policy implementation and are exposed to at least 2 years of free primary school. I consider only women born prior to 1995 to decrease the possibility of conflating age and policy effects; these women would be 8 years old at the time of policy implementation, and are exposed to at least 6 years of free primary school.

The regression kink design exploits an exogenous change in slope in the relationship between assignment to treatment a forcing variable x_f and a treatment variable D to estimate the causal impact of D on a variable on interest y. In this case, the introduction of FPE causes a change in access to primary school (D) at birth year (x_f) 1990. The estimate provides the causal effect of the FPE policy under the assumption that the trend in the outcome variable y would be unchanged in the absence of the policy. The design provides an estimate of the effect of a year of policy exposure on literacy and educational attainment. I estimate the change in slope at the birth year of first exposure to FPE, 1990. I estimate the following model via OLS to find the effect of the policy on educational attainment:

$$I(Attainment)_{ic} = \pi_1 + \pi_2(I(YOB \geq 1990) \times (YOB - 1990))_c$$
$$+ \pi_3(YOB - 1990)_c + e_{ic}. \tag{1}$$

The coefficient of interest, π_2, is an estimate of the effect of a year of exposure to the FPE program on the probability of attending at least some primary school.

The reduced form of the model, which I use to estimate the effect of the FPE policy on literacy, is

$$I(Literate)_{ic} = \tau_1 + \tau_2(I(YOB \geq 1990) \times (YOB - 1990))_c + \tau_3(YOB - 1990)_c + v_{ic}. \tag{2}$$

The coefficient of interest, τ_2, is an estimate of the effect of a year of exposure to the FPE program on the probability of being able to read a full sentence.

Individuals will be differentially affected by the FPE policy depending on many factors. Some children will experience a substantial increase in their access to primary education; poor children, children in rural areas, and girls are commonly found to be differentially affected by FPE and UPE policies (Al-Samarri and Zaman, 2007; Osili and Long, 2008; Deininger, 2003). On the other hand, children that were likely to have been in school in the absence of the policy may experience learning effects due to changes in classroom composition, resources, or exit from the public schooling system. To proxy for student likelihood of enrollment in the absence of the FPE policy, I use ethnicity. In particular, I estimate the above model for Kikuya and Somali individuals separately as well as for the full sample. Kikuya children were relatively likely to be enrolled prior to the policy and thus I assume they were relatively unaffected by the introduction of FPE; Somali children were relatively unlikely to be enrolled prior to the policy and the share of primary-educated Somali individuals increased for birth cohorts exposed to the FPE, so I assume they were relatively affected by the introduction of FPE. I choose

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to examine these two ethnic groups due to their respective probabilities of primary school completion among women not exposed to the FPE policy as well as the number of women I observe of both ethnic groups. These groups are two of the largest groups I observe, as well as the most extreme in terms of their pre-policy probabilities of primary school completion. If Kikuya primary school enrollment is unaffected by the policy change, there will be no kink in primary school attainment at birth year 1990. If Kikuya literacy is affected by the changed composition of students, there will be a kink in literacy rate at birth year 1990. In this case, if the effect on literacy is negative, the RKD estimator β will yield a negative estimated impact of exposure to primary education after the introduction of FPE on Kikuya individuals.

The regression kink design estimates a weighted average effect on students that would and would not have been enrolled in the absence of the policy. While my results suggest that the policy had no effect on high pre-policy enrollment ethnic groups, I cannot rule out the possibility of learning effects. It's possible that there was a negative learning effect on students that would have been enrolled in the absence of the policy which is offset by a positive learning effect on students that would not have been enrolled in the absence of the policy. Similarly, my estimates include students that may have withdrawn from public school or moved to private school; if students that attended public schools post-policy experienced negative effects, those may be offset by positive effects on students that moved to private school due to the policy.

5   Data

I use data from the 2014 round of the Kenya Demographic and Health Surveys (DHS) to analyze the introduction of Kenya's FPE program. DHS is a nationally representative survey including individual-level data on an abundance of factors including educational attainment, ethnicity, age, domestic violence, and residence characteristics. For this project, I use the women's survey, which includes data on 31079 Kenyan women aged 15-49. I employ data on literacy to proxy for individual-level returns to education; educational attainment; ethnicity to proxy for intensity of treatment exposure; and year of birth to determine exposure to FPE.

Kenya's FPE program, in expanding access to education, changed the composition of Kenya's student population. Table 1 presents the ethnic makeup of individuals of different levels of educational attainment before and after the introduction of FPE. The Kikuya group, which dominated the primary and secondary school attainers before the policy, saw their share of each attainment population fall significantly after the FPE introduction. The Mijikendu/Swahili and Somali ethnic groups, on the other hand, saw their shares of the primary and secondary attainer populations increase significantly after the policy change. It seems likely that, rather than reducing the number of Kikuya students enrolled in primary and secondary schooling, the policy increased the number of Mijikendu/Swahili and Somali students, increasing their shares of the student population and decreasing the share of Kikuya students.

Due to my inability to separate age/cohort effects from policy effects, I restrict my sample to women born prior to or in 1995. Women born in 1995 would be 18-19 at the time of observation. I analyze outcomes that are likely to be fully realized by age 19 to minimize the probability of confounding age effects. Women born in 2000, for example, would be 14-15 at the time of observation. Many of these women would not have had the opportunity to complete some amount of secondary school, and none would have had the opportunity to complete secondary school. The estimated policy effects would be negative due to the decreasing probability of secondary school completion among women of younger cohorts, who would be too young at the time of observation to have completed secondary school.

6   Results

6.1   Educational attainment

Figure 2 shows the results of estimating equation (2) for the full sample and Kikuya and Somali women separately. The full results of these regressions can be found in Table 2. I estimate the effect of one year of exposure to the FPE policy on the likelihood of having completed at least some primary school. I find that among all the women in my sample, a year of exposure increases probability of completion of at least some primary school by 2.3 percentage points (2.7% relative to the pre-policy average probability of having completed at least some primary school of 84.5%). Likelihood of completion of at least some primary school is high for Kikuya women on both sides of exposure to the FPE policy; it is slightly higher for women born after 1990. There is a modest discontinuity at the first birth cohort exposed to FPE, and a modest and insignificant change in slope. This suggests that the policy change likely did not substantially affect Kikuya primary school attainment, though I cannot rule out the possibility of counterbalancing effects originating from differential effect on subgroups within the Kikuya population. The attainment of Somali students appears to have been substantially increased by the policy; my estimates suggest that an additional year of policy exposure increases the probability of completing at least some primary school by 4.3 percentage points (28.5% increase relative to the pre-policy probability of 15.1%) for Somali women. Again, I am unable to rule out the possibility of heterogeneous effects among Somali women.

Next, I examine the effect of the FPE policy on the likelihood of having completed primary school. The results of this analysis are summarized in Figure 3, and the full results can be found in Table 3. The results are broadly similar to the results of partial completion of primary school. I find that a year of exposure to the FPE policy increases the probability of primary school completion by 1 percentage point among all women in my sample, a 1.6% increase relative to the pre-policy average of 60.9%. I find no significant policy effect on Kikuya attainment, and a 3.8 percentage-point increase (a 39.6% increase relative to the pre-policy average of 9.6%) in the probability of having completed primary school for each year of policy exposure among Somali women.

Finally, I examine the effect of the FPE policy on the likelihood of having completed some secondary school. The results of the analysis are summarized in Figure 4, and the full results are reported in Table 4. I estimate that a year of exposure to the policy increases the probability of having completed some secondary school by 2.1 percentage points among all women in my sample, a 6% increase relative to the pre-policy average of 34.7%. I find that Kikuya women seem again relatively unaffected by the policy change in this regard, though I do estimate a 1.9 percentage-point (3.7 %) increase in the probability of having completed some secondary school for each year of exposure to the policy (significant at the 90% level). Somali women, on the other hand, are 3 percentage points (52.6%) more likely to have completed some secondary school for each year of exposure to the policy. Only 5.7% of unexposed Somali women in my sample completed at least some secondary school.

6.2 Literacy

Figure 5 shows the results of estimating equation (3) for the full sample and Kikuya and Somali women separately. The full results of these regressions can be found in Table 5; equation (3) corresponds with the reduced-form results in that table. I find that a year of exposure to the FPE policy increases the probability of being able to read a full sentence by 2.4 percentage points among all women in my sample, a 3.4% increase relative to the pre-policy average probability of 70.6%. Literacy rates for Kikuya women in my sample are increasing over time, but there is no significant slope change in 1990 for this group. An additional year of exposure to the policy for Somali women, on the other hand, seems to have a significant and large positive effect on their probability of literacy. I find that a year of exposure increases a Somali woman's probability of literacy by 4.9 percentage points (52.7% increase relative to the pre-policy average probability of literacy among Somali women of 9.3%). As before, I am unable to rule out heterogeneous effects for either group.

7 Conclusion

In this paper, I analyze the effect of exposure to Kenya's 2003 elimination of public school fees through its FPE program on literacy and educational attainment. I find that the program increased attainment and literacy slightly among all women analyzed. I examine the effects of program exposure on groups with high and low probability of pre-policy enrollment separately. I find that the program did not substantially affect the probability of completing at least some primary school, of completing primary school, or of being able to read a full sentence by age 18 among women of ethnicities with high pre-policy primary school enrollment rates. I do find a slight increase in probability of having completed some secondary school among these women. At the same time, I find that a year of exposure to the policy increased the probability of having completed at least some primary school by 28.5% for women of ethnicities with low pre-policy primary school enrollment rates; I find that a year of exposure increases the probability of being able to read a full sentence by 52.7% among the same

women.

Importantly, I cannot rule out the possibility of heterogeneous effects within these groups. It is possible for example, that a subset of Kikuya women experienced negative learning effects from the policy - due to increased class sizes, for example - while another subset of Kikuya women experienced positive learning effects - for example, due to an expansion of access to primary education. Because the RKD estimator is a weighted average, these two opposite effects could result in a null result.

Of particular interest are the potential marriage market and fertility effects of the policy. Such dramatic positive effects for low pre-policy enrollment groups suggest potential increases in bargaining power among such groups in labor and marriage markets as well as within the household. One crucial weakness of my empirical strategy is that it does not allow for controlling for age/cohort effects. The RKD strategy assumes that age/cohort effects would remain unchanged in the absence of the FPE policy; as a result, any age/cohort effects that may exist will bias the RKD estimator. This makes causal analysis of outcomes with well-known life cycle patterns like wealth accumulation, fertility outcomes, and marriage market outcomes untenable. My data includes fertility histories for each woman as well as dates of marriage; as a result, it is possible to construct fertility measures that control for age. This is an important direction for future work.

Table 1: Ethnic Composition by Educational Attainment and Exposure to Policy

				Highest level of education attained					
	None			Primary			Secondary or higher		
	Pre	Post	Diff.	Pre	Post	Diff.	Pre	Post	Diff.
Embu	0.000	0.000	-0.000 (0.000)	0.016	0.007	-0.008 (0.002)***	0.019	0.016	-0.003 (0.003)
Kalenjin	0.049	0.037	-0.013 (0.008)	0.158	0.168	0.010 (0.008)	0.148	0.159	0.011 (0.008)
Kamba	0.014	0.006	-0.008 (0.004)**	0.121	0.096	-0.025 (0.007)***	0.099	0.105	0.006 (0.007)
Kikuya	0.012	0.004	-0.007 (0.003)**	0.184	0.095	-0.089 (0.007)***	0.261	0.196	-0.064 (0.009)***
Kisii	0.005	0.003	-0.002 (0.002)	0.052	0.044	-0.008 (0.005)*	0.098	0.076	-0.006 (0.006)***
Luhya	0.024	0.007	-0.017 (0.004)***	0.127	0.147	0.021 (0.008)***	0.128	0.138	0.010 (0.007)
Luo	0.010	0.002	-0.009 (0.002)***	0.117	0.128	0.011 (0.007)	0.094	0.114	0.020 (0.007)***
Maasai	0.063	0.107	0.044 (0.013)***	0.013	0.016	0.003 (0.003)	0.009	0.012	0.004 (0.002)
Meru	0.011	0.013	0.002 (0.005)	0.066	0.047	-0.018 (0.005)***	0.058	0.053	-0.006 (0.005)
Mijikendu/Swahili	0.109	0.060	-0.049 (0.011)***	0.050	0.090	0.040 (0.006)***	0.022	0.039	0.017 (0.004)***
Somali	0.309	0.309	0.000 (0.007)	0.009	0.022	0.014 (0.003)***	0.008	0.027	0.019 (0.003)***
Taita/Taveta	0.002	0.0000	-0.002 (0.001)**	0.019	0.010	-0.010 (0.002)***	0.019	0.013	-0.006 (0.003)**
Turkana	0.100	0.010	-0.001 (0.013)	0.009	0.024	0.015 (0.003)***	0.005	0.008	0.003 (0.002)*
Samburu	0.099	0.120	0.021 (0.014)	0.005	0.015	0.010 (0.003)***	0.003	0.004	0.002 (0.001)
Pokomo	0.008	0.009	0.001 (0.004)	0.013	0.020	0.007 (0.003)**	0.005	0.006	0.001 (0.002)
Iteso	0.005	0.000	-0.005 (0.001)***	0.011	0.014	0.003 (0.003)	0.006	0.009	0.003 (0.002)
Boran	0.050	0.044	-0.006 (0.009)	0.007	0.014	0.007 (0.002)***	0.004	0.005	0.001 (0.002)
Gabbra	0.030	0.045	0.015 (0.009)*	0.001	0.002	0.001 (0.001)	0.001	0.002	0.001 (0.008)
Kuria	0.004	0.002	-0.003 (0.002)	0.008	0.011	0.002 (0.002)	0.001	0.005	0.003 (0.001)**
Orma	0.016	0.018	0.002 (0.006)	0.001	0.003	0.001 (0.001)	0.000	0.000	0.000 (0.000)
Mbere	0.011	0.034	0.022 (0.007)***	0.001	0.002	0.001 (0.001)	0.001	0.001	0.000 (0.001)
Rendille	0.015	0.021	0.006 (0.006)	0.001	0.002	0.001 (0.001)	0.000	0.001	0.001 (0.001)

Notes: Standard errors are reported in parentheses. * denotes significance at the 90% level; **, significance at the 95% level; and ***, significance at the 99% level. Estimates represent the share of population held by a given ethnicity at a given education level. For example, of the survey respondents born prior to 1990 with secondary-level or higher educational attainment in 2014, 1.9% were Embu; of the respondents born in or after 1990 with secondary-level or higher educational attainment, 1.6% were Embu.

Figure 1: Primary school-age exposure to policy increases with cohort
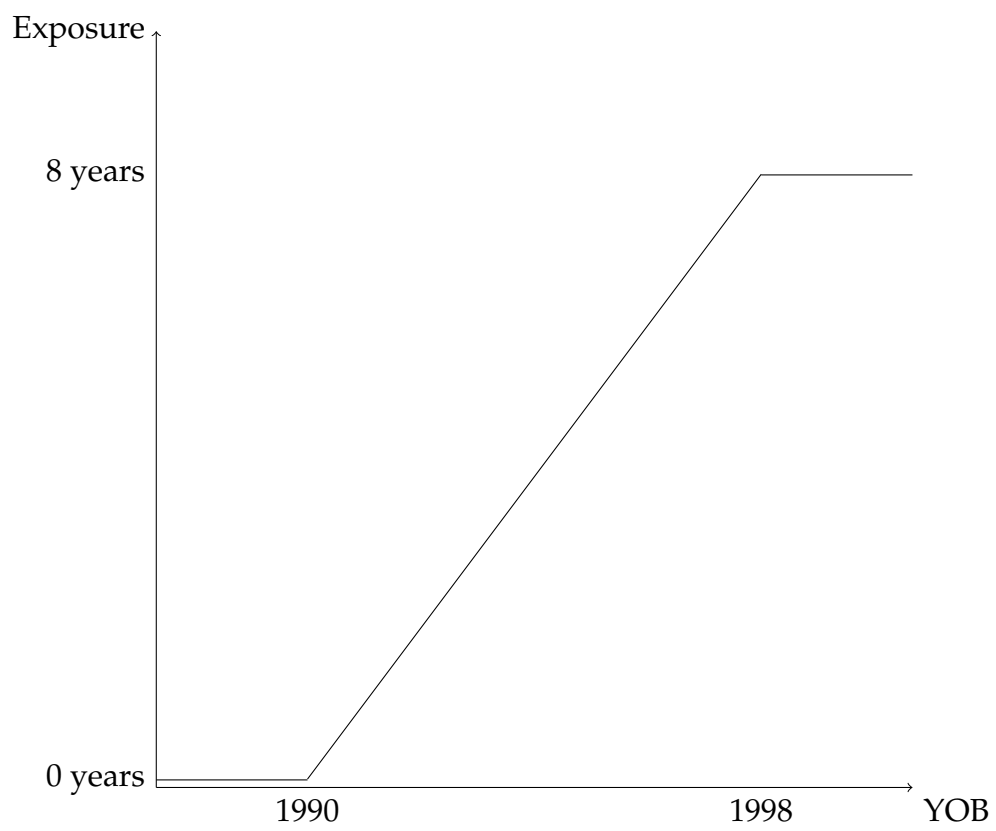
Table 2: Educational attainment RKD results: at least some primary school

	Full sample	Kikuya	Somali
(I(YOB ≥ 1990) × (YOB-1990))	0.023***	-0.001	0.043**
	(0.003)	(0.001)	(0.014)
YOB-1990	-0.003**	0.001	0.014**
	(0.001)	(0.001)	(0.005)
N	16911	2581	1000

Notes: Dependent variable is an indicator for completion of at least some primary school as reported by respondent. Heteroskedasticity-robust standard errors are reported in parentheses. * denotes significance at 10%, ** denotes 5%, and *** denotes 1%.

Table 3: Educational attainment RKD results: completed primary school

	Full sample	Kikuya	Somali
(I(YOB ≥ 1990) × (YOB-1990))	0.010**	-0.009	0.038**
	(0.004)	(0.006)	(0.013)
YOB-1990	0.007***	0.013***	0.010*
	(0.001)	(0.003)	(0.004)
N	16911	2581	1000

Notes: Dependent variable is an indicator for completion of primary school as reported by respondent. Heteroskedasticity-robust standard errors are reported in parentheses. * denotes significance at 10%, ** denotes 5%, and *** denotes 1%.

Table 4: Educational attainment RKD results: some secondary school

	Full sample	Kikuya	Somali
(I(YOB ≥ 1990) × (YOB-1990))	0.021***	0.019*	0.030**
	(0.004)	(0.009)	(0.012)
YOB-1990	0.010***	0.019***	0.010**
	(0.001)	(0.003)	(0.004)
N	16911	2581	1000

Notes: Dependent variable is an indicator for completion of at least some secondary schooling as reported by respondent. Heteroskedasticity-robust standard errors are reported in parentheses. * denotes significance at 10%, ** denotes 5%, and *** denotes 1%.

Table 5: Literacy RKD: first stage and reduced form results

	Full sample	Kikuya	Somali
First stage: completed at least some primary school			
(I(YOB $\geq$ 1990) $\times$ (YOB-1990))	0.023***	-0.001	0.043**
	(0.003)	(0.001)	(0.014)
YOB-1990	-0.003**	0.001	0.014**
	(0.001)	(0.001)	(0.005)
N	16911	2581	1000
Reduced form: literacy			
(I(YOB $\geq$ 1990) $\times$ (YOB-1990))	0.024***	0.005	0.049***
	(0.003)	(0.005)	(0.013)
YOB-1990	0.001	0.004	0.009*
	(0.001)	(0.002)	(0.004)
N	16911	2581	1000

Notes: Dependent variable is an indicator for self-reported ability to read a full sentence. Heteroskedasticity-robust standard errors are reported in parentheses. * denotes significance at 10%, ** denotes 5%, and *** denotes 1%.

Figure 2: FPE effect on educational attainment: some primary school

(a) Completed at least some primary school - full sample

(b) Completed at least some primary school - Kikuya
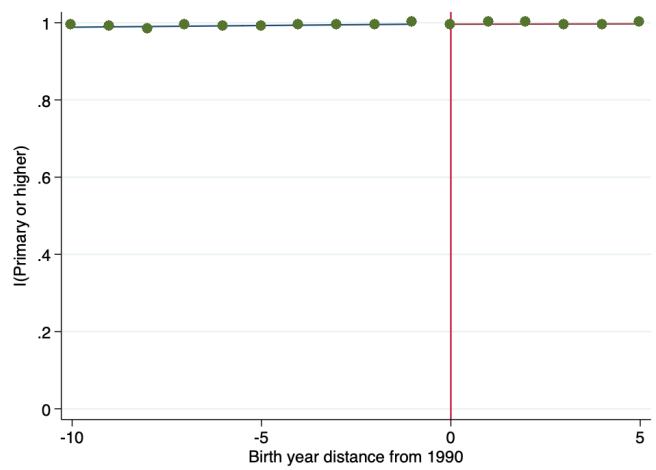
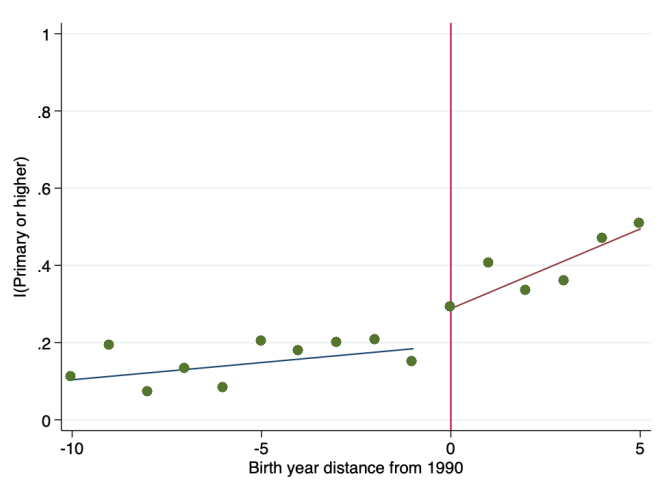## (c) Completed at least some primary school - Somali

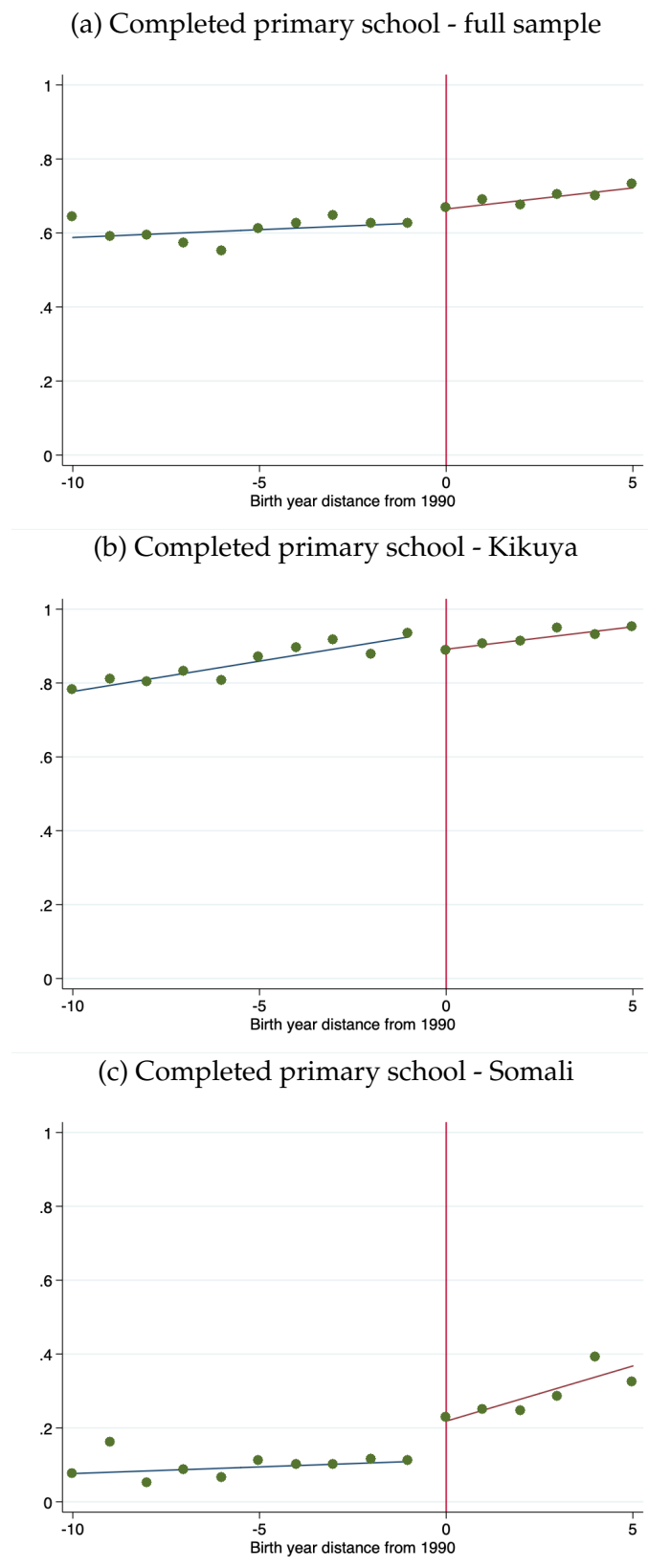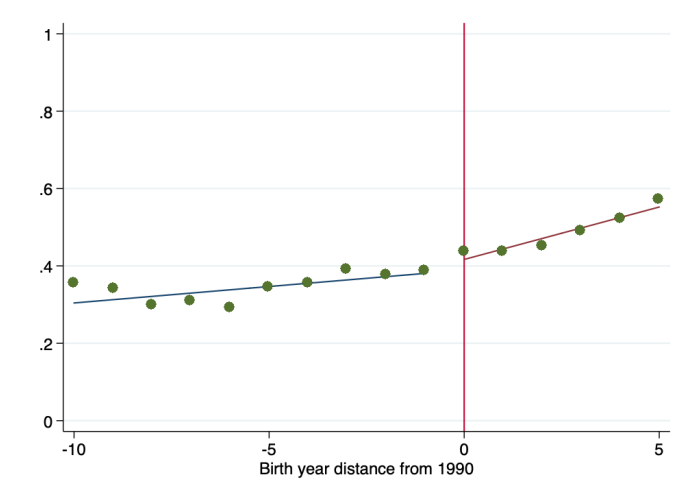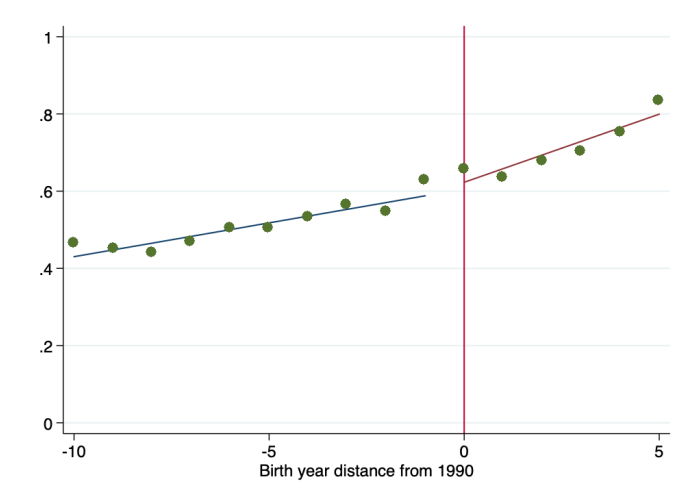# Figure 3: FPE effect on educational attainment: completed primary school

(a) Completed primary school - full sample

(b) Completed primary school - Kikuya

(c) Completed primary school - Somali

Figure 4: FPE effect on educational attainment: some secondary school

(a) some secondary school - full sample

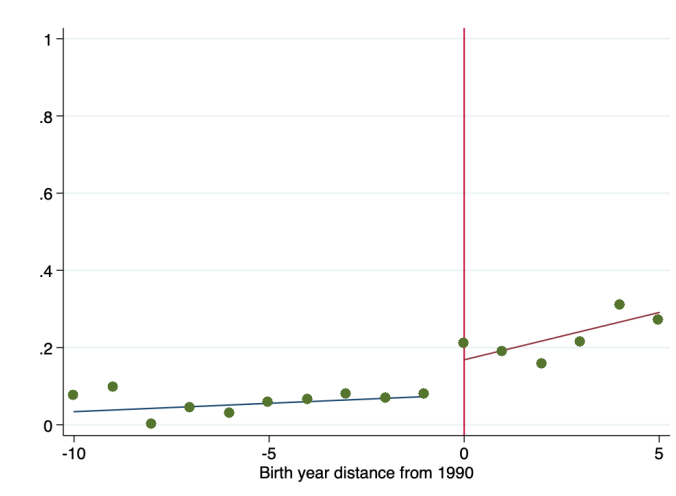## (b) Some secondary school - Kikuya

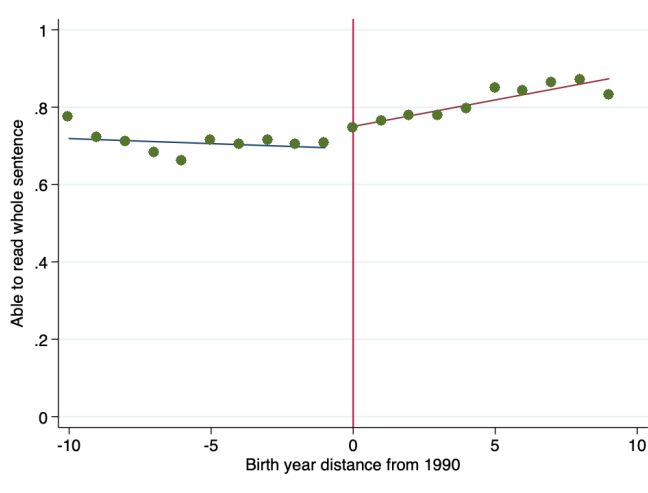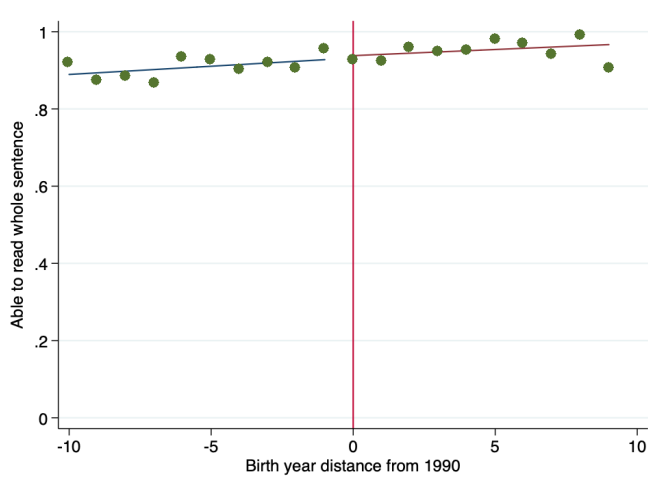## (c) Some secondary school - Somali

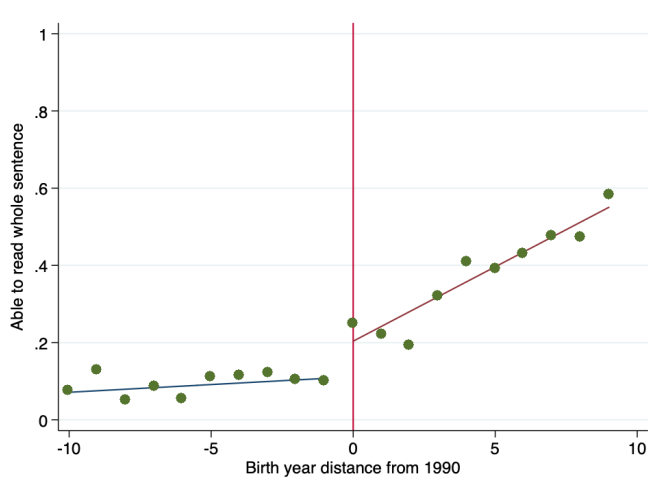# Figure 5: FPE effect on literacy

(a) Able to read a full sentence - full sample

(b) Able to read a full sentence - Kikuya

(c) Able to read a full sentence - Somali

References

Al-Samarri, Samer, and Hassan Zaman. 2007. "Abolishing School Fees in Malawi: The Impact on Education Access and Equity." *Education Economics*, 15(3): 359–375.

Behrman, Julia Andrea. 2015*a*. "Does Schooling Affect Women's Desired Fertility? Evidence From Malawi, Uganda, and Ethiopia." *Demography*, 52(3): 787–809.

Behrman, Julia Andrea. 2015*b*. "The effect of increased primary schooling on adult women's HIV status in Malawi and Uganda: Universal Primary Education as a natural experiment." *Social Science and Medicine*, 127: 108–115.

Bold, Tessa, Mwangi Kimenyi, Germano Mwabu, and Justin Sandefur. 2011. "Does Abolishing Fees Reduce School Quality? Evidence from Kenya." *Centre for Study of African Economies Working Paper*, 4: 1–47.

Bosworth, Ryan. 2014. "Class size, class composition, and the distribution of student achievement." *Education Economics*, 22(2): 141–165.

Deininger, Klaus. 2003. "Does cost of schooling affect enrollment by the poor? Universal primary education in Uganda." *Economics of Education Review*, 22(3): 291–305.

Duflo, Esther. 2001. "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment." *American Economic Review*, 91(4): 795–813.

Duflo, Esther, Pascaline Dupas, and Michael Kremer. 2011. "Peer Effects, Teacher Incentives, and the Impact of Early Tracking: Evidence from a randomized Evaluation in Kenya." *American Economic Review*, 101(5): 1739–1774.

Grogan, Louise. 2009. "Universal primary education and school entry in Uganda." *Journal of African Economies*, 18(2): 183–211.

Hoxby, Caroline M. 2000. "The Effects of Class Size on Student Achievement : New Evidence from Population Variation." *The Quarterly Journal of Economics*, 115(4): 1239–1285.

Hsieh, Chang T, and Miguel Urquiola. 2006. "The effects of generalized school choice on achievement and stratification: Evidence from Chile's voucher program." *Journal of Public Economics*, 90(8-9): 1477–1503.

Larreguy, Horacio, and John Marshall. 2017. "The effect of education on civic and political engagement in nonconsolidated democracies: Evidence from Nigeria." *Review of Economics and Statistics*, 99(3): 387–401.

Lucas, Adrienne M., and Isaac Mbiti. 2014. "Effects of School Quality on Student Achievement: Discontinuity Evidence from Kenya." *American Economic Journal: Applied Economics*, 6(3): 234–263.

Lucas, Adrienne M, and Isaac M Mbiti. 2012. "The short-run effects of free primary education in Kenya." *American Economic Journal: Applied Economics*, 4(4): 226–253.

Majanga, E.K., J.W. Nasongo, and V.K. Sylvia. 2011. "The Effect of Class Size on Classroom Interaction During Mathematics Discourse in the Wake of Free Primary Education: A Study of Public Primary Schools in Nakuru Municipality." *Current Research Journal of Social Sciences*, 3(1).

Nishimura, Mikiko, Takashi Yamano, and Yuichi Sasaoka. 2008. "Impacts of the universal primary education policy on educational attainment and private costs in rural Uganda." *International Journal of Educational Development*, 28: 161–175.

Osili, Una Okonkwo, and Bridget Terry Long. 2008. "Does female schooling reduce fertility? Evidence from Nigeria." *Journal of Development Economics*, 87(1): 57–75.

Sanders, Edmund. 2007. "The high cost of free education." *Los Angeles Times*.

The World Bank. 2004. "Kenya: Strengthening the Foundation of Education and Training in Kenya - Opportunities and Challenges in Primary and General Secondary Education." The World Bank.

Uwaifo Oyelere, Ruth. 2010. "Africa's education enigma? The Nigerian story." *Journal of Development Economics*, 91(1): 128–139.