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Does Abolishing Fees Reduce School Quality? Evidence from Kenya*

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Abstract

In 2003 Kenya abolished user fees in all government primary schools. We find that this Free Primary Education (FPE) policy resulted in a decline in public school quality and increased demand for private schooling. However, the former did not reflect a decline in value added by public schools - as anticipated if fees contribute to local accountability - but rather the selection of weaker pupils into free education. In contrast, affluent children who exited to the private sector in response to FPE benefited from a strong, causal effect on their exam

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performance which is robust to selection on unobserved ability.
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1 Introduction

In January 2003, newly-elected Kenyan President Mwai Kibaki announced the abolition of all school fees in government primary schools, fulfilling a campaign pledge of his National Rainbow Coalition. This new "Free Primary Education" (FPE) policy was heralded by international donors as a major step toward the Millenium Development Goal of universal primary education; over the subsequent five years the World Bank and the British Department for International Development contributed nearly $200 million to pay for the policy.

Under the FPE policy, government primary schools previously responsible for raising funds locally to pay for classroom maintenance, desks, books and other non-salary expenditures, are prohibited from collecting revenue. Instead, each school now receives a central government grant twice per year to cover these non-salary costs.

Concerns about the Ministry's capacity to maintain the quality of instruction under FPE arose quickly, as depicted in qualitative research by Tooley (2009), renewing decade's old debates about the role of user fees in achieving both allocative and productive efficiency in service delivery. These anecdotal concerns encompass three potential mechanisms, with very distinct policy implications, tying the abolition of user fees to changes in school quality, as measured by pupils academic achievement:

1. a change, of ambiguous sign, in the overall financial and teaching resources available in public schools;

2. a deterioration in the composition of students, as measured by educational background and proxied by socio-economic indicators; and

3. a loss of local accountability and "ownership" as the functions of Parent Teacher Associations are replaced by centralized grants.

This third set of concerns – emphasized frequently by head teachers in open-ended interviews conducted by the authors – flies in the face of a growing body of evidence from field experiments in developing countries which have yielded mostly reassuring results about the (lack of) trade-offs involved in free provision of public services. These studies have been able to isolate the effect of free distribution on allocative efficiency, as well as the psychological effects of sunk costs and "ownership" that may encourage recipients to make better use of a costly product. To cite two examples, in a randomized trial in Western Kenya, Cohen and Dupas (2010) found that free distribution of insecticide-treated nets had no negative effect on overall usage, or on targeting of the sickest clients, but dramatically increased overall demand vis-à-vis a small positive price. In Zambia, Ashraf, Berry and Shapiro (2010) investigated the psychological effect of price on subsequent use of a chlorine water-purification kit that must be re-applied regularly. They found that a higher offer price screened out clients less likely to use the product, but *ex post* rebates that reduced the actual price paid did nothing to undermine usage, implying no psychological "sunk cost" effects linking price to greater enthusiasm to use a good.[1]

The challenge of maintaining efficiency without charging fees may be more severe in the education context. A key element of service provision in education is missing from this existing literature: the role of clients in holding service providers accountable for quality service. This strategic interaction between government, service providers and clients that has dominated the theoretical literature on service delivery is absent in the cited examples of

[1] A parallel literature within behavioral economics based on laboratory experiments exploring the "non-budget constraint effects" of prices have similarly reached conclusions that would seem to discount any potential adverse consequences to free provision. Shampanier, Mazar and Ariely (2007), for instance, argue that "zero is a special price" and find that "people appear to act as if zero pricing of a good not only decreases its cost but also adds to its benefits."

ITNs and water purification which require action only by the end-user. Free education will be compatible with quality education only inasmuch as parents who do not pay fees are equally willing and able to demand effort from teachers, speak up in PTA meetings, monitor the appropriate use of school resources, and so on.

This paper tests whether these necessary conditions to maintain school quality in the absence of financial accountability to parents exist in a low income economy such as Kenya. We expand on earlier work on the abolition of school fees, particularly in East Africa, in three key ways. First, we provide, to our knowledge, the first comprehensive picture of the effects of free primary education on both enrolment (disaggregated by wealth) and scholastic achievement using nationally representative data. Second, we explicitly model and attempt to distinguish alternative mechanisms linking the abolition of fees to changes in school quality, including class size effects, socio-economic composition, and impacts on local accountability. Third, and in our view most importantly, we highlight the central but often neglected role of private schools in parents' response to FPE (Klaus Deininger 2003, Milu Charles Muyanga, John Olwande, Esther Mueni & Stella Wambugu 2010)

The rest of the paper is organized as follows. In the following section we begin by explaining how shifts in the demand for public and private schooling – as observed through equilibrium price (school fee) and quantity (enrolment) data – in response to a price change can expose shifts in underlying school quality. Further, we explain how examining social interactions in enrolment decisions can help to disentangle the three mechanisms mentioned above linking the abolition of fees to quality changes.

Section 4 presents the first piece of this demand model, examining changes in education expenditure under FPE. The first notable point is the dramatic rise in equilibrium school fees in the private primary school sector, consistent with an increase in demand in this sector. The second point to note is

that total financial and human resources available in public schools declined only slightly, making this an implausible explanation for any deterioration in quality.

Our main findings are contained in Section 5 on enrolment. We show that the primary school net enrolment rate (NER) in Kenyan government schools was virtually unchanged by the introduction of FPE, and FPE appears to have contributed to a *decline* in NER in government schools for wealthier households. Meanwhile, demand for private school swelled, as seen in a simultaneous doubling of both private enrolment levels and private school fee rates. We interpret this decline in demand for public schooling by wealthier households in response to a price decrease as *prima facie* evidence of deteriorating school quality.

Section 5.2 attempts to identify the specific mechanisms explaining middle- and upper-class flight from public schools. We show that increased class sizes and the changing socio-economic composition of government schools effectively explain the exit of some wealthier households to the private system. We find no evidence of reduced government school quality due to decreased managerial effectiveness or local accountability at the school level after controlling for these class size and composition effects.

Finally, Section 6 looks more closely at the role of private schools in the response to FPE. To assess the net effect of enrolment shifts across sectors on school quality, we use exam performance – standardized across all public and private schools – as our outcome metric. In public schools, the influx of new students placed significant downward pressure on scores. In contrast, the decision of many upper-income households to forego government schools in the wake of FPE and to enter the private system had a significant, positive effect on scores for these pupils. This causal effect of private schooling on exam performance is robust to selection on unobserved ability. The net effect of these two countervailing trends has been a widening public-private exam performance gap (and increased socio-economic sorting between public and

private schools), but roughly zero change in overall mean performance despite an increase in the number of test-takers.

2 Conceptual Framework

2.1 Inferring school quality through revealed preference

We seek to infer changes in school quality under FPE from shifts in enrolment and fee levels. In short, we argue that a decrease in quantity demanded in response to a price decrease is *prima facie* evidence of a change in the quality of the good (ruling out Giffen goods).

To illustrate our argument, it is useful to examine the likely effects of free primary education on public and private primary school enrolment in a simple supply and demand model, as shown in Figure 1. Consider households choosing between government and private schools, assuming that an individual child must be enrolled in either one system or the other. The downward-sloping demand curves for both public and private education reflect households' willingness to pay for each type of education. The supply curve is determined by the marginal cost of an extra unit of education and is assumed to be upward sloping.

The most obvious, predicted effect of the introduction of free primary education, as shown by the red lines in Figure 1, would be a fall in the price of public primary education. This yields a perfectly elastic supply curve for government schools at zero price. Holding constant the quality of education in each system, the effect of FPE on enrolment is unambiguous. Enrolment in public primary school increases and – because public and private schools are direct substitutes – enrolment in private primary school drops. This decline in demand for private schooling should be associated with a fall in the equilibrium price of private schools.

To give a preview of our empirical results, the actual shifts in enrolment (quantities) and fees (prices) observed in the data are quite different than those predicted above. In the public system, the quantity demanded fell in response to a price increase (for at least some socio-economic groups), while in the private system both prices and quantities increased dramatically.

Within the context of our simple supply-and-demand model these shifts imply a downward shift in the demand for public schooling and an increase in the demand for private schooling, as illustrated by the blue lines in the bottom panel of Figure 1. What might explain this shift? Clearly, the assumption of constant educational quality may be too strong. A decrease in public school quality would be consistent with the patterns illustrated here. Indeed, there is widespread concern in the Kenyan press that the quality of education received by Kenyan students has suffered since the introduction of free primary education. Much of the empirical analysis below will attempt to establish the basic shifts in quantity and price asserted here, and in the process to corroborate the anecdotal claims of a decline in quality.

2.2 Mechanisms linking the abolition of fees to school quality

Consider three channels through which the abolition of fees might affect educational quality in public primary schools:

First, the total level of funding available in the education sector on a per pupil basis may change. The lost revenue to local schools due to the ban on raising fees from parents must be weighed against an increase in public finance for education. As discussed in Section 4, under FPE the central government has introduced new grants for non-salary expenditures disbursed directly to local schools. Therefore the effect on total funding available is *a priori* ambiguous.

Secondly, FPE may lead to a change in the pool of students in public primary schools: As fees are abolished, many more children can access edu-

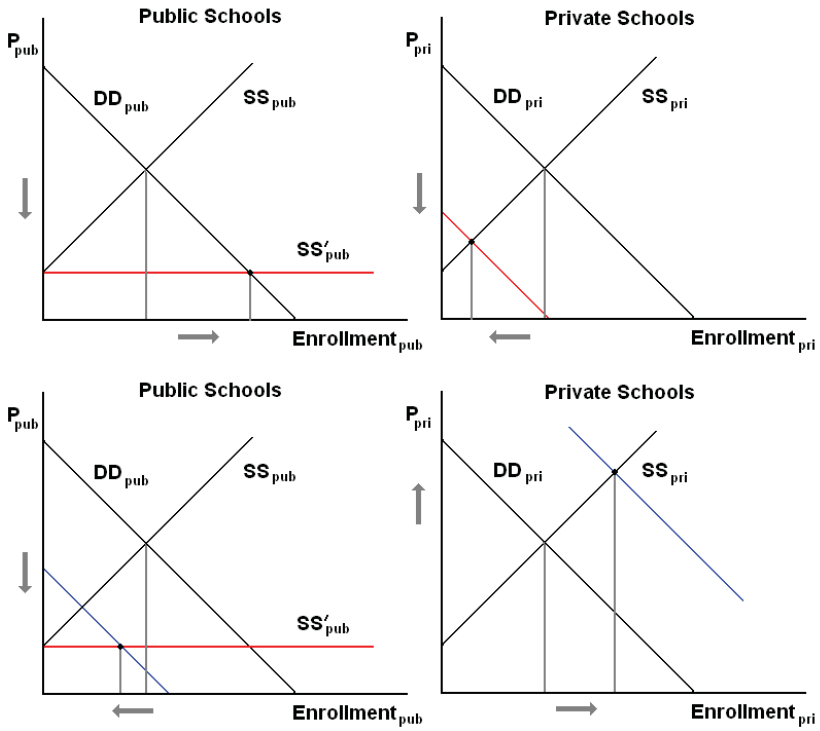


Figure 1: Anticipated effects (top panel) and observed effects (bottom panel) from the abolition of user fees in public schools.

cation. The children who enter education after 2003 may differ from existing students in terms of socio-economic background, age and ability.

Finally, the increased centralization may lead to a weaker accountability relationship between clients and service providers. School management committees no longer raise funds and as a result their governance power is undermined. Equally, parents no longer pay for the school, so they may lose a sense of ownership. As noted in the introduction, this potential channel from FPE to a change in school quality is closely related to recent experimental work on the efficacy of free distribution of goods related to public-health initiatives, such as bed nets and water treatment kits. The added element in the education context is that customers using a free service are required not only to make complementary investments (e.g. using the bed net, applying the water chlorination, or buying a uniform for their child), but also to interact with service providers and hold them accountable for the quality of service (e.g., by attending PTA meetings, complaining if teachers are routinely absent or children are not progressing). There are many anecdotes, but little hard evidence, that parents who pay for schooling will be more assertive in holding schools accountable for performance.

In the following analysis, we will try to disentangle these three effects and show the relative importance of each of them.

3 Data

We draw on two broad types of data: household survey data, which underlies the core of our analysis, and school-level administrative data. Both data sets span the period before and after the enactment of FPE.

3.1 Household survey data

The analysis of education expenditure and enrolment is based on two consecutive, nationally-representative, cross-sectional, household surveys conducted

by the Kenya National Bureau of Statistics. The first round of data comes from the 1997 Welfare Monitoring Survey (WMS), which includes a sample of 10,874 households – which account for 13,639 children age 6 to 13 – interviewed roughly five years prior to the introduction of FPE. The second round of data is taken from the 2006 Kenya Integrated Household Budget Survey (KIHBS), spanning 13,212 households (with 14,610 children age 6 to 13), interviewed after three full school years under FPE had been completed.

These datasets are well-suited to our needs in that they include comparable modules on school enrolment from before and after the onset of FPE, distinguishing between public and private school attendance. Use of integrated household surveys with detailed consumption and expenditure information allows us to highlight changes in the socioeconomic composition of public and private school enrolment over this period. In addition, specific questions on education expenditure provide the basis for examining pre-reform variation in government school fees and secular changes in the equilibrium price of private schools. The clustered nature of the household survey samples – providing information on multiple households in the catchment area of a given public or private school – is central to our empirical strategy to estimate social interaction effects, including the impact of school crowding on the incentive to send one's child to a government or private school.

3.2 School-level administrative data

We use administrative data from the Ministry of Education and the Kenya National Examination Council (KNEC) to provide additional school characteristics, which constitute a subset of the determinants of enrolment in our analysis. Our combined administrative data set constitutes a panel of all public and private primary schools in Kenya, for each year from 1998 to 2006. However, the breadth of information available varies between public and private schools. KNEC administers the Kenya Certificate of Primary Education (KCPE) examination to students from all schools, both public

and private, and all scores are publicly available. The test covers English, Kiswahili, math, science and history; the art and business exams introduced in 2001 are excluded here. The KCPE exam constitutes the sole, nationwide, standardized test for primary students in Kenya, administered at the completion of eight years of education. Note that sitting the KCPE is a necessary requirement for completion of primary school, but is not necessarily taken by all pupils enrolled in grade eight, and the self-selection of exam takers should be borne in mind when interpreting the analysis in Section 6. The school-level data set contains information on the average score achieved by girls and boys in the school, the number of test-takers of each gender, the district of the school and whether it is government or private.[2]

4 Public and private education expenditure

The first potential mechanism linking FPE to school quality listed above was a change in physical, financial or human resources within schools. This section attempts a reckoning of the net changes in school resources under FPE, combining household data sources on parental contributions with official government data on capitation grants and pupil-teacher ratios. We begin with a brief discussion of the institutional arrangements governing school finance in Kenya and how they changed with FPE.

4.1 Before FPE: *Harambee*

Prior to the introduction of FPE, non-salary expenditure for schools was obtained through events known as *harambee*, which aimed to raise financial and in-kind contributions for education and development from local communities. The *harambee* movement was actively cultivated by the Kenyatta

[2]For public schools, the Ministry's Educational Monitoring Information System (EMIS) database also provides detailed information on staffing levels, teacher characteristics, school infrastructure, etc., but this information is not collected for private schools.

government after independence and contributions were raised through public fund-raising drives. While in principle voluntary, in practice children whose parents had not made any harambee contributions were suspended from school (Mary Kay Gugerty & Edward Miguel 2005).

In contrast to the changes that occurred in the financing of non-salary education expenditure, the system of teacher employment and local school governance has remained the same. All teachers are centrally recruited, hired and fired, assigned and reassigned and paid by the Teacher Service Commission, a subsidiary of the Ministry of Education located in Nairobi. At the local level, school management committees, consisting of parents, the head teacher, and district education board officials, have official governing authority for each school.

4.2 Household expenditure patterns

We begin by examining the price effect of the introduction of FPE. In other words, has FPE reduced the cost of schooling for children enrolled in public primary school. To examine this question, we simply look at household expenditure on education before and after FPE, distinguishing between fees and other expenditure, and emphasizing the contrast between the public and private system. We estimate these costs as follows

$$\begin{aligned} \mathsf{Exp}_{it} &= \gamma_{p0}\mathsf{Pri}_{it} + \gamma_{p1}(\mathsf{Pri}_{it} \times \mathsf{FPE}) \\ &+ \gamma_{s0}\mathsf{Sec}_{it} + \gamma_{s1}(\mathsf{Sec}_{it} \times \mathsf{FPE}) + u_{it} \end{aligned} \tag{1}$$

where Exp_{it} is a measure of the education expenditure for household i in period t, Pri_{it} and Sec_{it} measure the number of household members enrolled in primary and secondary education respectively. Note that equation (1) contains no constant and the dummy variable for FPE is only included as an interaction term. Thus the γ_{p0} and γ_{s0} can be read directly as the average

level of spending per pupil before FPE, and γ_{p1} and γ_{s1} as the change in spending per pupil under FPE.

Columns (1) and (2) of Table (1) show the composition of real annual household expenditure on private and public primary schooling both before and after FPE. The main result to take away from Table 1 is that total expenditure on public primary schooling has effectively halved since the introduction of FPE and the expenditure on fees has effectively gone to zero, while the total expenditure on private primary schooling has more than doubled in the same time span. All these effects are significant at the 1% level. Therefore the introduction of FPE has had the expected price effect and total household expenditure on public primary education has indeed fallen. One explanation for the dramatic increase in expenditure on private primary education could indeed be that the quality of public primary schools may have fallen in the wake of FPE, inducing parents to enroll their children in private school.

For comparison purposes, columns (3) and (4) report the results from the same analysis applied to expenditure on secondary education. Since secondary education was funded by parental fees during the entire period, this can be regarded as a placebo experiment. As can be seen from column (3) and (4), expenditure on secondary education is high, but the relative difference between private and public expenditure is much smaller than in the primary sector both before and after the introduction of FPE. Moreover, total expenditure on secondary schooling has dropped in both sectors over the period (by 20% in terms of total expenditure and by 50% in terms of fees in the public sector. Expenditure in the private sector has also dropped, although the effect is not significant). Hence, it is not the case that we are merely observing an overall increase in demand and thus price for private schooling. Rather, this increase is restricted to the primary sector, which has been subject to FPE. (Figure (2) reports the same data graphically.)

The fact that expenditure on private and public primary schooling have

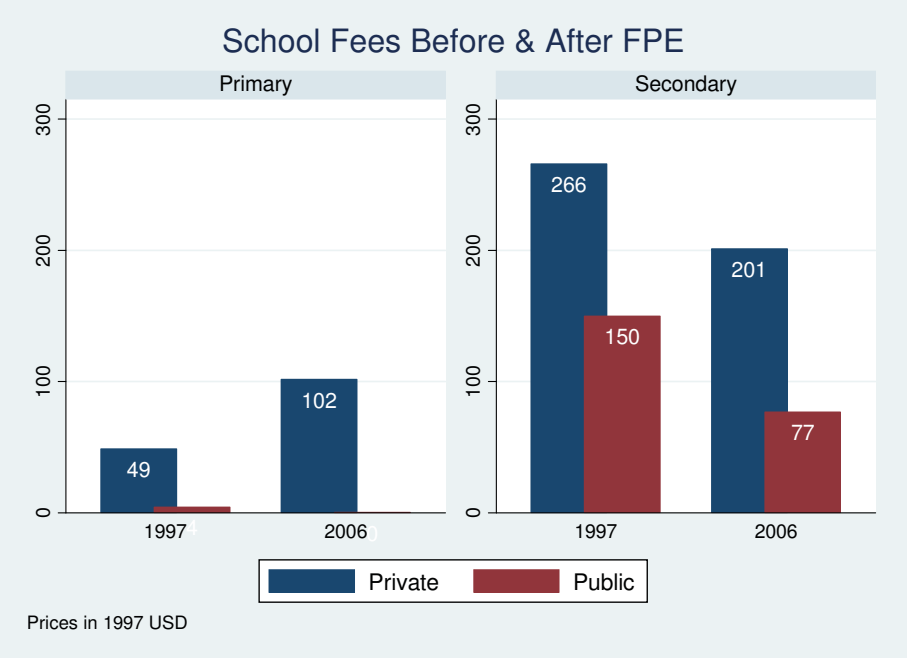


Figure 2: Average household expenditure on public and private primary schools before and after FPE.

moved in opposite directions while expenditure on private and public secondary expenditure have moved in the same direction gives additional support to our hypothesis that the introduction of free primary education has had both a price effect (lower cost of public primary schooling) and a quality effect, which led to an increase in the demand for private primary schooling.

4.3 Government expenditure patterns

A press statement by a former U.S. policymaker provides a succinct summary of the financing system as it was intended to run under FPE, and the confidence it inspired in the donor community:

Table 1: Household educational expenditure

	Exp. on Primary		Exp. on Secondary	
	All	Fees	All	Fees
	(1)	(2)	(3)	(4)
Children in public primary	638.24	217.15		
	(19.69)***	(14.50)***		
Children in private primary	3592.08	2440.98		
	(640.44)***	(574.23)***		
FPE × Children in public primary	-297.09	-197.30		
	(26.63)***	(19.32)***		
FPE × Children in private primary	4325.59	2642.72		
	(962.48)***	(822.85)***		
Children in public secondary			10192.02	7496.12
			(501.25)***	(459.64)***
Children in private secondary			15933.68	13289.38
			(4419.98)***	(4268.23)***
FPE × Children in public secondary			-1984.66	-3659.26
			(600.33)***	(496.41)***
FPE × Children in private secondary			-215.22	-3234.19
			(5242.75)	(4849.94)
Obs.	17,238	17,238	17,238	17,238

The dependent variable is total annual household educational expenditure in 1997 Kenyan Shillings. In columns 1 and 2 the dependent variable includes only expenditure on primary education, and in columns 3 and 4 only on secondary education. Columns 1 and 3 include all categories of educational expenditure available in both surveys (i.e., fees, books, uniforms, board, and transport) for the relevant education level. Columns 2 and 4 are restricted to fees only. The FPE variable takes a value of one in 2006 and zero in 1997. Independent variables labeled "Children in ..." measure the total number of children in the household enrolled in a given type of school. The sample is restricted to households that have at least one child in either primary or secondary school. Numbers in parentheses report heteroskedasticity-robust standard errors.

Table 2: Per Pupil Resources with Schools - Before & After FPE

	Government		Private	
	1997/8	2006	1997/8	2006
Private Expenditure				
Fees	217	20	2,441	5,084
Other	421	321	1,151	2,733
Total	638	341	3,592	7,817
Capitation Grant				
Allocated	0	493	0	0
Disbursed	0	324	0	0
TSC Teacher Salaries	2,566	2,065	0	0
Total, excl. other priv. spending	2,783	2,409	2,441	5,084
Grand total	3,204	2,730	3,592	7,817

All figures are measured in real 1997 Kenyan Shillings. Actual capitation grants disbursed are based on media reports of the results of a Price Waterhouse Cooper audit of FPE funds. Teacher salary expenditure is based on (a) a PTR of 28.6 in 2002 and of 33.3 in 2004, and (b) an average TSC salary of Sh.19,372 among sampled teachers in a separate survey of 192 schools conducted in July 2009, deflated appropriately. This figure understates the increase in expenditure on teachers, as real salaries have likely risen considerably over the period.

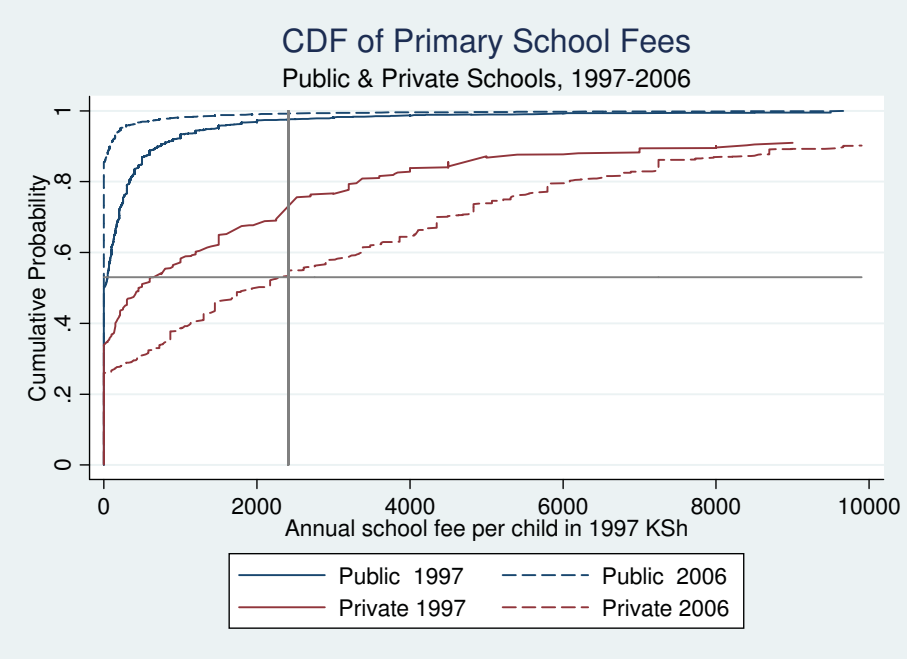


Figure 3: The distribution of household expenditure on public and private primary schools before and after FPE. The vertical line represents our best estimate of the average funding level of public primary schools, K.Sh. 2,409 per annum, equivalent to the 53^{rd} percentile of the fee distribution in private schools.

> "The Ministry of Education has garnered international respect through both excellent civil servants like Permanent Secretary Karega Mutahi and Basic Education Secretary George Godia as well as their decentralized and transparent system for dispersing funds to local school districts. Rather than hold the money in the Ministry of Education, Kenya ensures that every shilling gets to the local level by depositing a per-child grant of 1,020 Kenyan Shillings (approximately $15 USD) to local banks accounts for each school. The headmaster is then required to post the amount received in plain view (which I saw firsthand in school after school that I visited) and work more closely with parent committees on how to spend the money than anything I had witnessed in the United States." (Gene Sperling 2008)

Despite these measures to prevent graft, inspired in part by the Ugandan experience, an external audit of the FPE funds commissioned by the Ministry of Finance in 2009 found enormous shortfalls in actual disbursements. While the parliament approved Sh. 1,020 per pupil in 2003, actual funds received fell short of that in each subsequent year audited: short by Sh. 75 in 2004, by Sh. 140 in 2005, Sh. 350 in 2006, and Sh. 50 in both 2007 and 2008. Press reports estimated that roughly Sh. 5.5 billion ($68 million) of the Sh. 47.5 billion ($590 million) FPE budget from 2004 to 2008 had been misdirected (Andrew Teyie & Henry Wanyama 2010), leading the President to suspend several top Ministry officials, and foreign donors including DfID and USAID to freeze aid disbursements in December 2009.

In addition to the capitation grants, the key resource provided to schools by the central government is teaching staff. In principle, FPE might have contributed to a rise or fall in per pupil resources if staffing levels did not keep pace with changes in enrolment. Our estimates based on the EMIS data described above show that national pupil-teacher ratio in public primary schools rose modestly from 26.8 pupils per teacher in 2002 to 33.3 in

2004. As of 2009, average teacher salaries were Sh. 5,731 per month, in real 1997 Shillings, based on a nationwide survey of teacher salaries conducted by Oxford University and the Kenya National Examination Council (Kenya National Examination Council 2010). Unfortunately, we lack data on the change in real teacher salaries over time. There is strong reason to suppose that average salaries increased: real starting salaries for new teachers rose dramatically over this period. (Changes in average salaries will also reflect changes in the distribution of teacher tenure due to hiring and retirement.) By applying a constant real wage rate over time we thus probably ignore salary rises that might partially or wholly compensate for the effect of the slight rise in pupil-teacher ratios on per-pupil spending rates.

Table (2) presents our best estimate of the overall level of per pupil expenditure, combining our findings on private expenditure with actual disbursements from government FPE funds and changes in the pupil-teacher ratio. As seen in the table, when converting to real 1997 Shillings, the decrease in private expenditure in public primary schools is almost perfectly offset by the rise in public expenditure through capitation grants. However, because pupil-teacher ratios rose, our estimate of spending per pupil declined modestly from Sh 2,783 to Sh 2,409 per pupil per annum. (We omit "other" household expenditure on education, as this includes uniforms and transportation, which do not accrue to schools.) In contrast, per pupil spending in private schools increased by a much larger margin from a baseline of Sh 2,441 to Sh 5,084 as noted above.

Looking beyond averages, Figure (3) shows the full distribution of household fee payments (based on the same data presented in Figure (2)) by parents enrolling children in public and private schools before and after FPE. As already seen, private fee rates are substantially higher. However, when accounting for central funding in the form of capitation grants and teacher salaries after FPE this ceases to be true. The vertical line in Figure (3) represents our best estimate of the average total funding level per pupil from

Table (2) – including teacher salaries – of public primary schools, K.Sh. 2,409 per annum. As seen, this is equivalent to the 53^{rd} percentile of the fee distribution in private schools, implying that a slim majority of private school pupils are served by smaller budgets than their public school counterparts.

To summarize the overall picture on per pupil expenditure before and after FPE: we find that the abolition of public school fees stimulated higher fee levels in the private sector. Nevertheless, combining household and government expenditure, most private schools remained cheaper than public schools on a per pupil basis even after FPE – and even when ignoring the additional public monies lost to graft under FPE. Because private schools are funded via fees, however, this of course does not imply that private schools are an accessible alternative for poor households. We turn now to the question of access among rich and poor households, and to the core issue of this paper, the impact of FPE on school quality.

5 Enrolment

This section investigates the determinants of enrolment patterns, modeling household choices between government schools, private schools, and not enrolling. The analysis is based on repeated cross section household survey data from 1997 (WMS) and 2006 (KIHBS) which allows us to examine the effects of the 2003 FPE policy. We investigate the determinants of government and private primary school enrolment separately, to better understand the socio-economic dynamics underlying the response to FPE. We also replicate this analysis on secondary schools, as a control group of sorts, to examine whether other factors, independent of FPE (which did not apply to secondary schools) influenced enrolment shifts. In particular, we attempt to answer two questions: (1) Has FPE been a pro-poor policy? (2) Has FPE resulted in a deterioration of public school quality, distinguishing changes in schools' value-added from changes in pre-existing pupil ability?

Table 3: Gross & Net Enrolment Rates in Public and Private Schools, Before & After FPE, by Expenditure Quintile

	Primary				Secondary			
	NER		GER		NER		GER	
	1997	2006	1997	2006	1997	2006	1997	2006
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Government schools:								
All Quintiles	71.2	71.6	100.1	103.5	14.3	17.1	18.6	21.3
Quintile 1	68.1	66.8	101.1	99.1	10.1	13.4	14.5	16.2
Quintile 2	71.6	70.6	104.6	101.8	13.3	15.0	18.1	20.6
Quintile 3	71.5	71.3	100.6	105.1	16.8	15.3	19.8	20.8
Quintile 4	73.6	74.7	100.2	109.6	14.0	20.3	21.0	23.5
Quintile 5	72.4	71.7	91.7	100.4	19.9	18.0	22.5	22.4
Private schools:								
All Quintiles	3.8	8.9	4.3	11.4	2.4	3.7	2.1	4.8
Quintile 1	2.4	5.7	2.9	7.0	1.1	2.1	1.1	3.2
Quintile 2	2.3	8.2	3.4	8.3	1.7	2.9	1.9	4.2
Quintile 3	3.3	6.8	4.0	9.1	3.5	4.1	2.5	3.9
Quintile 4	4.4	9.1	4.3	11.0	3.2	2.9	2.4	4.2
Quintile 5	8.3	11.8	8.3	16.3	3.6	5.3	3.0	6.7

5.1 Has FPE reduced inequality in educational attainment?

A principal motivation for abolishing user fees in education is to increase the participation of poorer children whose parents cannot afford schooling in the absence of Free Primary Education. We look at whether FPE has indeed had the desired effect by asking whether the relationship between socio-economic indicators and primary enrolment status has weakened since the introduction of FPE.

We begin by laying out a formal model of enrolment. The enrolment decision is modeled as follows. Households indexed by i, maximize utility by choosing between three schooling options $j = \{N, G, P\}$, i.e. not enrolling (N), attending a government school, (G), or attending a private school (P) in schooling market m.[3] Utility is an increasing function of the education acquired, adjusted for quality, subject to the constraint that the cost of education is less than disposable income, which we treat as exogenous: $U_i = U_i(Q)$ s.t. $P_j^m Q_j^m \leq Y_i^m$, where $U'(Q) > 0$. While both prices and quantities may vary across space and time, for every household we assume that there is a uniform ordering of alternatives such that $Q_{i,P} > Q_{i,G} > Q_{i,N}$ and $P_{i,P} > P_{i,G} > P_{i,N}$.

For the sake of the empirical analysis, we write down a random additive utility model for household $i's$ utility from choice j in market m at time t (A. Colin Cameron & Pravin K. Trivedi 2005):

$$\begin{aligned} U_{ij,t}^m &= U_i(Q_j) && (2) \\ &= \delta_{j,t}^m + \mathbf{Z_{ij,t}^m}\beta + \varepsilon_{ij,t}^m && (3) \end{aligned}$$

Utility depends on: (1) a set of individual characteristics $Z_{ji,t}^m$, which reflect

[3]It makes sense to model the enrolment decision as taking place in many separate markets, since pupils in Kenya in reality choose among a small number of primary schools in their immediate vicinity.

household's preferences for education option j in market m as well as their ability to afford it pre-and post-FPE, (2) a fixed effect $\delta^m_{j,t}$, which measures the value that is particular to a school sector in market m at time t, and which is shared by all individuals and (3) a random component $\varepsilon^m_{ij,t}$. The household will choose the school option that yields the highest utility.

Of course, we cannot observe household utility and instead estimate the probability of observing a particular school choice. Assuming that the errors $\varepsilon^m_{ij,t}$ in (3) are independently distributed with a type I extreme value function leads to a conditional logit model for the probability of choosing a particular school option as a function of the regressors (Cameron & Trivedi 2005). The $Z^m_{ij,t}$ vector consists of log food consumption of the household and the years of education of the household head, which are interacted with dummies for each of the j sectors as well as a dummy variable for 2006. This enables us to estimate both choice- and individual-specific effects in the conditional logit framework (Jeffrey M. Wooldridge 2001) and to examine changes in the slope coefficients under FPE. The δ^m_{jt} are a full set of district-sector dummies for pre- and post-FPE.

Before turning to the econometric estimates, the simple summary statistics in Table 3 provide a basic picture of the changes underway since FPE. Overall, net enrolment rates in government primary schools rose negligibly from 71.2% to 71.6% from 1997 to 2006. Net enrolment increases were in fact larger in government secondary schools where fees were maintained. Meanwhile net enrolment rates in private primary schools rose from 3.8% to 8.9% over this period, while the increase for private secondary schools was much smaller, going from 2.4% to 3.7%. Disaggregating enrolment rates by expenditure quintiles (based on per capita food expenditure in the household, the best comparable, monetary welfare indicator available in the two survey rounds), we see that enrolment rates in both public and private primary schools are higher for wealthier than poorer households in both years, as expected. Looking at changes over time, net public primary enrolment fell

slightly for some quintiles and rose for others, though there is no clear relationship between these changes and wealth. Net private primary enrolment rose for all quintiles.

The evolution of inequality in educational access is somewhat clearer in a multivariate context, and in particular when looking at parental education as an indicator of wealth. The results from estimating Equation (3) are reported in Table (4) and reproduced in Figure (4). Column (1) shows the results for primary enrolment. As anticipated, FPE reduces inequality in access to public primary school, *ceteris paribus*. For the pre-FPE period, there is a small, positive, and significant association between both household log food consumption and household head education and the probability of enrolment in government primary school. With the advent of FPE, socio-economic inequality in government primary enrolment was signficantly reduced but not eliminated (as seen in the coefficients on the interaction of log food-FPE and household head's education with FPE). These patterns are qualitatively similar to findings for Uganda after the abolition of fees (Deininger 2003). Looking at private schools, while consumption and education of the household head were already significant predictors of enrolment prior to FPE, post-FPE inequality in access to private primary schools widened significantly (as shown by the positive coefficients on the interaction of logfood and household education with FPE). In short, FPE opened the doors of government schools to poorer children, while more affluent children exited to the private sector.

For comparison purposes, we also report the same set of regressions for secondary schools. If the reduction in inequality in public primary enrolment is in fact due to FPE, then we should not see any similar effects in secondary school. This is indeed the case, as can be seen from column (2) of Table (4), consistent with the patterns observed in the summary statistics in Table (3). While we see some reduction in inequality in secondary enrolment when using the log food consumption variable – analogous to the outcomes for primary enrolment – the coefficients on the household head's education point

significantly in the opposite direction for secondary schools. This failure to find the same systematic pattern of enrolment shifts – of poorer households into government schools and richer households into private schools – provides additional confidence that the effects we observe in the primary sector are indeed due to the abolition of school fees in public primary schools rather than an artefact of secular trends independent of the FPE policy.

5.2 Why did the rich leave?

Having shown that FPE had a positive effect on inequality in educational access, we will now examine its impact on school quality by decomposing the sector-specific fixed effects, $\delta^m_{j,t}$ in the enrolment equation (3) and separately identifying peer effects and school quality effects in the decision to enrol.

In Section (2) we argued that the fall in net enrolment in government primary schools in response to the abolition of fees is *prima facie* evidence that school quality declined. We refer to this as the "revealed preference argument" for a deterioration in quality. In this section we take this argument a significant step further. We argue that identifying precisely who entered the public school system post-FPE and who exited to the private system – and in particular, the interaction between these two flows – can provide clues about the role of class size and peer composition in the motivations to enrol. In short, we argue that *enrolment* data may elucidate mechanisms linking FPE to changes in school *quality*. Furthermore, who leaves and where will be informative about the causes of quality decline – i.e., whether school value-added has fallen or performance is deteriorating due to a change in student composition.

Section (2) outlined three avenues by which FPE can affect the quality of schooling and therefore the decision to enrol in public versus private school: (a) school finances, (b) enrolment decisions of peers, which help determine both expected class size as well as the 'quality' of peers in a given school, and (c) the underlying quality of the school, capturing unobserved managerial

talent, teaching ability, staff motivation, etc. We examined the effect of (a) in Section (4). We now want to disentangle the effect of the remaining two. We cannot measure (c) and will therefore treat it as a residual term in the regression of enrolment on its various determinants. In other words, it is analogous to the underlying total-factor productivity of the school and we are interested in determining how this has been affected by FPE. Of course, measuring this "underlying quality" residual requires us to first properly identify and control for the peer effects in term (b).

Briefly, the problem in distinguishing peer effects, (b), from unobserved correlated effects, (c), is that they are observationally equivalent. An increase in unobserved school quality will mechanically increase enrolment and therefore the enrolment shares of peers even in the absence of local spillovers. To paraphrase Ellison and Glaeser's (1997) 'equivalence theorem' regarding identification of spillovers in an industrial organization context, "the relationship between mean measured levels of [enrolment] and [school] characteristics is the same regardless of whether [enrolment] is the result of [peer effects], [unobserved school characteristics], or a combination of the two." The next section presents our instrumentation strategy for overcoming this equivalence.

5.3 Identifying social interactions in enrolment decisions

Returning to the enrolment model in the previous subsection, consider now the determinants of education quality in a given school j in schooling market m, and in particular the role of peer effects. Let $Q_j^m = Q(\bar{E}_j^m, \bar{Y}_j^m)$, $\frac{\partial Q_j^m}{\partial \bar{E}_j^m} \leq 0$, $\frac{\partial Q_j^m}{\partial \bar{Y}_j^m} \geq 0$, where $\bar{E}_j^m$ is the number of individuals choosing enrolment option j in schooling market m, and $\bar{Y}_j^m$ is the average household income of individuals choosing enrolment option j in schooling market m. In words, the quality of education in a given school is decreasing in class size and increasing in the

Table 4: Enrolment: Conditional Logit for School Sector Choice

	Prim.	Sec.
Gov Dummy × Log Food	0.0280***	0.0139
	(0.005)	(0.166)
Gov Dummy × Log Food × FPE	-0.0187	-0.0127
	(0.220)	(0.350)
Gov Dummy × Head's Educ	0.0149***	0.0146***
	(0.000)	(0.000)
Gov Dummy × Head's Educ × FPE	-0.00375*	0.000777
	(0.077)	(0.681)
Priv Dummy × Log Food	0.134***	0.00180
	(0.000)	(0.937)
Priv Dummy × Log Food × FPE	0.0478	0.0726**
	(0.118)	(0.010)
Priv Dummy × Head's Educ	0.0424***	0.0235***
	(0.000)	(0.000)
Priv Dummy × Head's Educ × FPE	0.0155***	-0.00580
	(0.001)	(0.162)
Observations	69,513	26,247

Figures in the table are parameter values from the conditional logit model. The three choice options are "none", "government" and "private". District dummies are included but not shown. Figure (4) provides a more intuitive visual representation of these results, illustrating the relationship between the log food consumption and the probability of enrolment in each sector before and after FPE.

average income of peers. These peer effects yield multiple equilibria in the enrolment choices of households in a given schooling market m.

To estimate the model, we return to equation (3) from the previous section:

$$\begin{aligned} U_{ij,t}^{m} &= U_i(Q_j(\bar{E}_{j,t}^{m}, \bar{Y}_{ij,t}^{m})) \\ &= \delta_{j,t}^{m} + \mathbf{Z_{ij,t}^{m}}\beta_1 + \varepsilon_{ij,t}^{m} \end{aligned} \tag{4}$$

Furthermore, we now estimate the j-level fixed effects as

$$\delta_{j,t}^{m} = \mathbf{X_{j,t}^{m}}\beta_0 + \alpha\sigma_{j,t}^{m} + \xi_{j,t}^{m} \tag{5}$$

$\delta_{j,t}^{m}$, the common value of choosing a particular school type, is determined by:

1. Observable characteristics of school type j, $\mathbf{X_{j,t}^{m}}$ in market m pre- and post-FPE. In our application, these would be school characteristics, of the government and private school within the choice set of a given district. Available school characteristics are exam performance (KCPE scores) of the public and private schools in the district, as well as a set of sector-specific dummies for the pre-and post-FPE period.

2. The share of children enrolling in the same school type, $\sigma_{j,t}^{m}$

3. A choice-specific unobservable $\xi_{j,t}^{m}$, which is invariant to enrolment decisions. In this context, the most obvious characteristics captured by ξ is the unobserved quality of the nearby government and/or private primary school. Estimating changes in this residual over time – analogous to a change in TFP – is a key objective of the estimation.

Again assuming a type I extreme value distribution, we can estimate the probability of observing a particular school choice by a conditional logit model. This model is intended specifically for problems where choices are at

least partially determined by observable attributes of each alternative, and we will make use of this property in our identification strategy.

To identify the peer effect, we must isolate that variation in enrolment (and therefore in the peer effect, which is constructed by averaging individual enrolment choices for each sector) that is not correlated with unobserved quality effects. Bayer and Timmins (2007) propose a novel strategy to identify peer effects (a.k.a., social interaction effects or local externalities) by using variation in the underlying choice set of individual agents. This strategy is particularly suited for applications meeting two conditions. First, data are available on a large number of agents endogenously sorting into a fixed set of categories; in our application this involves choosing between government schools, private schools, or not enrolling. Second, data are ideally required on many distinct markets where such sorting occurs; in our application, a market is defined as a district, on the assumption that pupils or their parents do not shop for primary schools outside the district where they reside.

The strategy proposed by Bayer and Timmins (2007) uses the fixed attributes of options which were not chosen to construct an instrument for the enrolment decisions of a pupil's peers. The characteristics of a valid instrument in this context are that it be correlated with the number of pupils who choose a given school, but not correlated with the unobserved fixed attributes of that school. The fixed characteristics of the schooling options not chosen by a given individual – e.g., the characteristics of nearby private schools for students in public school, and vice versa – will provide the content for such an instrument under the assumption that individuals have idiosyncratic bliss points for their enrolment decisions and/or vary in their sensitivity to the qualities and costs of each schooling option, and that this variation is at least partially correlated with observable individual characteristics. To put it more simply, it must not be the case that all students prefer to go to private school, just because it offers the best quality. In the presence of such heterogeneity of preferences and budgets, the attributes of the schooling options that were

not chosen in each market will contain information that predicts enrolment decisions of an individual's peers, but do not affect school quality. In general, any non-linear function of the exogenous characteristics of chosen school type and its close by alternatives that drive enrolment would qualify as a valid instrument as long as there is some variation in the choice set of individuals.

5.4 Estimation

We will now describe how to estimate the peer effect consistently using an iterative estimation procedure following Bayer and Timmins.

1. Estimate (4) to generate predicted values for $\hat{\delta}_j^{m,t}$ and $\hat{\beta}_1$. Guess $\hat{\beta}_0^0$, where the superscript indicates the iterative step.

2. Construct an instrument for σ_{jt}^m to be used in the estimation of Equation (5)

$$\tilde{\sigma}_{j,t}^{m,0} = \frac{\exp(\mathbf{X_{j,t}^m}\hat{\beta}_0^0)}{\sum_{k\in m}\exp(\mathbf{X_{k,t}^m}\hat{\beta}_0^0)} \tag{6}$$

3. Use $\tilde{\sigma}_{jt}^{m,0}$ to estimate Equation (5) and recover $\hat{\beta}_0^1$ and $\hat{\alpha}_0^1$.

4. Use $\hat{\beta}_0^1$ and $\hat{\beta}_1^1$ to construct a new instrument $\tilde{\sigma}_{jt}^{m,1}$ to be used in the estimation of (4) and (5). Iterate on step (2) – (4) until β and α converge.

Convergence of the algorithm implies that expectations are self-consistent. In other words, the share of individuals choosing each school type that enters the utility function (4) is equal to that derived from averaging over pupil's choices implied by these enrolment shares.

Close inspection of Equation (6) makes the instrumentation strategy very explicit. The estimation only uses variation in enrolment shares that is driven

by the exogenous characteristics of a particular school type and its alternatives in the same location. Unobserved quality and peer effects are both set to zero. Because individuals make choices in many separate markets, we introduce variation in the excludable variables $X_{k\neq j,t}$, i.e. those that are uncorrelated with ξ, in the denominator of (6). This drives the identification.

To reiterate, identification does not rest on having to correctly specify the model's error distribution. This would only be the case if there was no variation in the underlying choice set, for then the denominator in (6) would not vary and identification would rely entirely on X_j entering (5) non-linearly. Rather, we choose a conditional logit model because it is one (of many) ways to parameterize a utility/choice model that embodies precisely the – in our view plausible – identification assumption: exogenous characteristics of other schools drive enrolment choices, but do not affect own unobserved quality.

5.5 Results

We now discuss the estimation results. Table (4) presents the first stage results from the conditional logit model. These results, which show that FPE had an equalizing effect, have been discussed above and we now turn to the results of the second-stage estimation. These are found in Table (5). As anticipated, schools with higher KCPE scores attract more students and – after instrumenting the σ variable – we find negative peer effects, i.e., the share of pupils choosing school type j has a negative effect on the probability of an additional pupil choosing j.

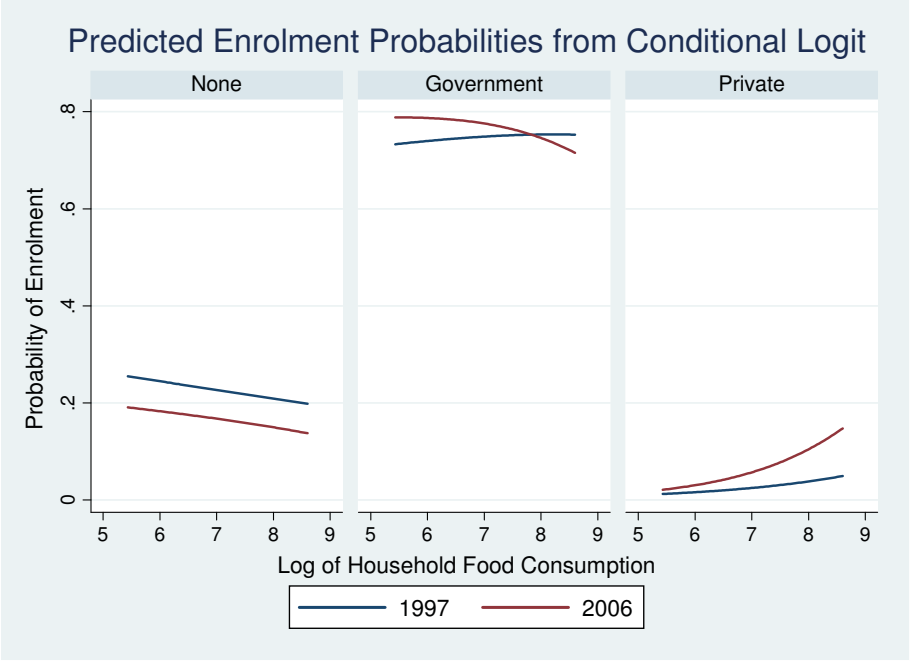
Having estimated the peer effects consistently, we implicitly back out the variables of interest, i.e. the ξ_j terms, and examine how these residuals (analogous to TFP residuals) for public and private schools evolved after the implementation of FPE. These effects are captured by the interaction of the government and private-school dummies with the FPE dummy in Table (5). The significant positive coefficient on the interaction of the government-school dummy and the FPE dummy indicates that the demand for public

schooling actually increased under FPE. This suggests that changes in class size more than explain the shift in the demand toward private primary education in Kenya in the wake of FPE. Thus there is no evidence here of any residual decline in the demand for public schooling, which one might associate with a decline in school management or local accountability affecting school quality. To understand the economic significance of the point coefficients, we calculate the marginal effect of FPE in both public and private schools, combining the coefficients from Table (5) and Table (4). The average marginal effect of FPE on private enrolment represents a 2.6% decline, while for public schools it represents a 6.3% increase in enrolment. This should not be interpreted to imply that public school quality increased, but rather that demand for public schooling – controlling for personal characteristics and peer effects – increased in response to a price decrease (as anticipated in the absence of a severe decline in quality).

To summarize, basic summary statistics show that the net enrolment rate for government primary schools stagnated under FPE. In this section we have shown that the the failure of a price decrease to stimulate a demand increase is related to the change in the composition of peers in public schools. Any sign of quality decline in public schools is consistent with the phenomenon of free schools attracting poorer pupils and thus driving affluent households away, rather than any deterioration in the value-added of public schools.

6 Achievement

The previous sections used enrolment and expenditure data to demonstrate that abolishing public school fees contributed to an expansion of *private* school enrolment, particularly among middle- and upper-income households. This section uses achievement data – drawn from the national KCPE exam database, encompassing all public and private schools each year from 1998 to 2005 – to examine the implications of this 'affluent flight' to private schools



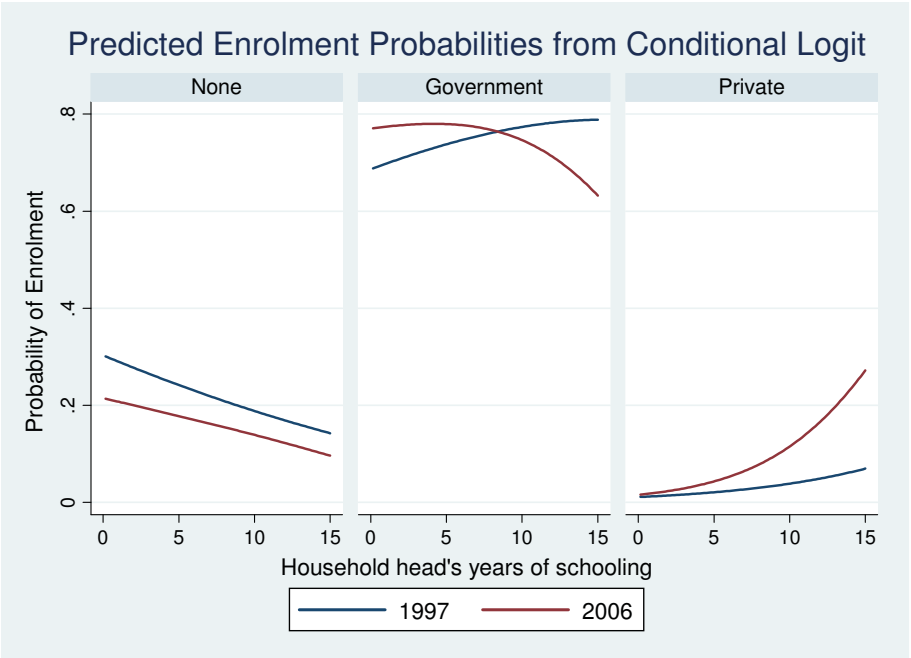


Figure 4: Predicted net enrolment rates by log food expenditure and household head's education: Before & after FPE, based on the estimates of the conditional logit model in Table (4).

Table 5: Enrolment: Determinants of the δ_j

KCPE Score	0.0134***
	(0.006)
Gov't Dummy	-3.024***
	(0.005)
Private Dummy	-2.970
	(0.470)
Gov't Dummy × FPE	0.752**
	(0.025)
Private Dummy × FPE	-0.341
	(0.312)
σ_j^m	-8.401*
	(0.094)
Observations	176

The table reports estimates of Equation (5), the second step of the Bayer-Timmins procedure. The dependent variable is the district fixed effect from the conditional logit in Table (4). σ_j^m is the instrumented share of pupils choosing school type j in market m, and KCPE is the average exam score for schools of type j in market m.

for test performance.

To preview our results, we show that (a) the expansion in the overall number of public and private test-takers eroded average scores, but that (b) children migrating to the private sector experienced large test-score gains. On net, we estimate that these two effects roughly canceled out. This is, in our judgment, a measure of the success of FPE: the total number of test-takers increased, yet average performance was roughly unchanged. The mechanism explaining this success was hardly what policymakers intended however: FPE helped to buoy average scores precisely by driving pupils away from low-performing public schools and into high-performing private schools.

We focus first on measuring the effect of private schooling, and return at the end of the section to link the discussion to the role of FPE. Note that we do not attempt to estimate any equation directly linking test scores to the FPE reform. Directly estimating the effect of FPE on achievement in this

way is complicated by two issues. First, FPE was introduced universally in 2003 making a straightforward differences-in-differences approach infeasible. Second, scores on the national standardized test, the KCPE, are re-based each year so that the average score nationwide does not change from year to year.[4] Thus our strategy to investigate the trajectory of academic achievement under FPE is as follows. We use changes in *relative* performance across districts to assess the impact of two major shifts putatively induced by FPE: (i) an increase in the overall number of test-takers across all school types, and (ii) a shift in enrolment toward private schools. We then apply these parameters to the overall national trends in public and private enrolment to simulate the trajectory of the average KCPE score nationwide.

6.1 Identification strategy

The main econometric contribution of this section is to estimate the causal effect of private schooling on test performance for Kenyan primary school students. The key to our identification strategy is aggregation. Clearly, private schools may outperform public schools either because of the causal influence of private schooling on scores, or the selection of more able students into private schooling, or some combination of these factors. However, the transfer of pupils from public to private schools, as happened in the wake of FPE, will only affect average scores – aggregating over both public and private schools – inasmuch as there is a genuine causal force at work.

Following on this logic, we take as our dependent variable the average score across both public and private schools for all students of a given gender, in a given district, and a given year. These cells are chosen to be as small as possible to allow sufficient degrees of freedom for estimation, but large enough so that students cannot endogenously select out of their cell. We

[4]Crucially, this re-basing preserves changes in relative performance between sub-groups of test takers – in particular, between sexes, public and private schools, and districts. Indeed, the public-private performance gap in exam scores grew from 14.7% in 1998 to a peak of 22.2% in 2003 and 2004. See Table (6).

regress these average scores on the proportion of pupils in private schools within the gender-district-year cell, controlling for cell-specific fixed effects. In contrast to early work in this area (Donald Cox & Emmanuel Jimenez 1990), aggregating exam scores across public and private schools allows us to remain agnostic about the sorting process of pupils across schools. Our approach is similar in this respect to that of Hsieh and Urquiola (2006).

To reiterate, our strategy to identify the causal effect of private schooling on test performance is robust to any form of endogenous selection of pupils (by unobserved wealth, ability, etc.) into private schools. Furthermore, we control for time-invariant cell characteristics that my be correlated with private school enrolment.

The consistency of our fixed-effects estimates hinges on the strict exogeneity of private enrolment shares conditional on an unobserved district-gender-cell effect. Translating this strict exogeneity assumption to our specific application, we require that (*i*) students choose between government and private schools within their own district, and (*ii*) year-to-year changes in the proportion of pupils in private schools within a given district are driven primarily by supply-side factors. The second assumption is justified in the Kenyan context given the large supply-side shock of the FPE reform. Additionally, the exogenous flow of new graduates from teacher-training colleges (combined with a hiring freeze for public school teachers in place since 2001) is widely seen as a key factor behind the growth of the private system.

To be explicit about the limitations of the fixed-effects approach, note that our results would be compromised by district-level, idiosyncratic shocks to the demand for private schooling that also directly influence exam performance. An example of such a shock would be a district-specific (positive) income shock that increases households' ability to pay for private schooling, and also increases human capital accumulation through, say, improved nutrition. We control for any economic shocks of this sort which are common across districts using year dummies.

To see more clearly how data aggregation overcomes selection bias, we can write exam performance, Y, of individual i in school-sector j of district-gender cell d at time t as a function of district and time effects, the impact of private education, and an idiosyncratic error term.

$$Y_{ijdt} = \rho_0 + \rho_d + \rho_t + (\rho_{p0} + \rho_{p,ijdt})\mathsf{Private}_{ijdt} + \upsilon_{ijdt} \tag{7}$$

The $\rho_{p,ijdt}$ reflects the possibility of idiosyncratic returns to private schooling, i.e., heterogeneity in treatment effects. Naively estimating Equation (7) by OLS using pupil- or school-level data will produce the following coefficient on the private school dummy:

$$\tilde{\rho}_p = \rho_{p0} + \lambda_\rho + \lambda_\upsilon \tag{8}$$

where

$$\begin{aligned} \lambda_\upsilon &\equiv E[\upsilon_{ijdt}|j = p] - E[\upsilon_{ijdt}|j = g] \neq 0 \text{ and} \\ \lambda_\rho &\equiv E[\rho_{p,ijdt}|j = p] \neq 0 \end{aligned}$$

Equation (8) highlights two sources of selection bias: selection of more (or less) able individuals into private schools, λ_υ, and selection of individuals with a higher (or lower) idiosyncratic return to private education into private schools, λ_ρ.

Aggregating the data into district-gender cells – assuming the district contains the entire choice set of schools for an individual of either gender – can overcome the first source of bias. Estimation of Equation (7) by OLS using cell-level data yields

$$\hat{\rho}_p = \rho_{p0} + \lambda_\rho \tag{9}$$

where the λ_υ term drops out due to the inclusion of a full vector of cell and time dummies. In the terminology of the evaluation literature, $\hat{\rho}_p$ is a local average treatment effect, measuring the average return to private schooling

for those who choose to enrol in private schools. This coefficient is, for many but not all policy questions, the parameter of interest; it gives the average effect of the growth in private schooling over our study period. If we wish to extrapolate our results to speculate about the impact of a further expansion of private schooling, it may be desirable to model the heterogeneity in treatment effects, i.e., to put some structure on $\rho_{p,ijdt}$. In principle $\rho_{p,ijdt}$ may vary along any number of dimensions. For our policy application, a relevant question is whether further expansion of private schooling will lead to diminishing marginal effects. We can measure this particular form of heterogeneity in returns by allowing for a more flexible functional form with respect to the variable of interest, i.e., the proportion of children in private schools. Thus our final estimating equation is,

$$\overline{Y}_{dt} = \rho_0 + \rho_d + \rho_t + \rho_{p0}\overline{\mathsf{Private}}_{dt} + \rho_{p1}\overline{\mathsf{Private}}^2_{dt} + \overline{\upsilon}_{dt}, \tag{10}$$

using a panel of average KCPE scores within 150 district-gender cells for the eight-year period from 1998 to 2005.

6.2 Results

Table (7) shows the results from estimating Equation (10), with various combinations of district and year fixed effects.[5] With the inclusion of both location and time effects, we find a gap between private and public schools of 103.2 exam points, or roughly two and a half standard deviation of the school-level test scores, that is not driven by self-selection of students into private schools. To account for the effect of expanded enrolment on the quality of instruction and the socio-economic composition of test-takers, we also

[5]The estimation sample of 976 observations represents 61 districts over eight years, with two gender cells per district and year. The full population comprises 68 districts or 1,088 observations. The districts containing the largest 1% of year-on-year changes in KCPE scores or private enrolment shares were dropped due to concerns about data accuracy for these observations – leading to a loss of seven districts. Inclusion of these outliers does not affect the sign or significance of the coefficients of interest.

include controls for the total number of students taking the exam. Estimates with the full set of dummies suggest a small, negative effect from increased enrolment, equivalent to 3.7 points lower for each additional thousand students enrolled in the district.

This causal exam performance premium of 2.5 standard deviations delivered by private schools is substantial; compare, for instance, the .16 standard deviation increase in exam performance achieved by hiring contract teachers in Kenyan primary schools documented by Duflo et al. (2009*a*).[6] Furthermore, from a social perspective private schooling is relatively cheap: recall from Section (4) that a majority of children in private schools pay fees less than the per-child funding levels to public schools under FPE.

Column (2) of Table (7) shows estimates of a quadratic specification, allowing for the possibility that as private schooling expands marginal students will experience diminishing benefits. Estimates show no evidence of such diminishing effect. Both the linear and quadratic terms on the private enrolment share are positive, though the quadratic term is imprecisely estimated and insignificant.

6.3 Re-constructing the secular trend in exam performance

Finally, the predicted values from the estimation in Table (7) provide the basis for our re-construction of the time series of KCPE scores, which attempts to remove the annual re-basing of the scores. There are two countervailing effects to consider, as just discussed: the increase in overall enrolment (partially associated with FPE) will place negative pressure on scores, while the

[6]This very large implied effect refers to a binary switch from government to private schooling, which is relevant for an individual pupil but not for a district. The national increase in the proportion of private-school test-takers from 1998 to 2005 was roughly 4.9%. Thus our econometric estimates imply that this fairly dramatic expansion of private schooling led to a 5 point increase in average scores (point estimate of $103.2 \times 4.9\%$ increase in private schooling), or 0.12 standard deviations of school-level average scores.

increase in the share of private students will tend to raise scores (also partially attributable to FPE). Figure (5) shows our estimates of the likely time-path of adjusted KCPE scores over time, showing both the enrolment and privatization effects separately, as well as the overall net effect.[7] As seen in the figure, considering the increase in enrolment alone suggests scores would have fallen by roughly 6 to 7 points (from 247 to 241) from 1998 to 2005, while considering only the privatization effect would have led to an increase of roughly 5 points (247 to 252). The net effect is a slight decline of approximately 2 points in the average national score relative to the starting point in 1998. This pattern is consistent with our estimates from the enrolment model, suggesting that FPE may have placed downward pressure on exam scores by increasing enrolment, but this negative effect was counteracted by the exit of more affluent students to private schools where their scores went up.

7 Conclusion

The central finding of our analysis is that the introduction of Free Primary Education has increased access to schooling for poorer households, but also contributed to a decline in the quality of education in government primary schools. This latter effect is evinced by the decline in net enrolment in government schools among middle- and upper-income households in the wake of FPE, and the surge in both enrolment and fee levels in private primary schools. The fact that these patterns were limited to primary schools, and not seen in secondary enrolment or fee levels, further reinforces the conclusion that they are attributable to FPE rather than other events over the same period, and that FPE led to an increase in demand for private education.

[7]The overall net effect is calculated as the average predicted value for KCPE scores in a given year based on the model in Table (7), where predicted values are calculated without including the effect of time dummies. These time effects are omitted on the grounds that annual scores are re-based.

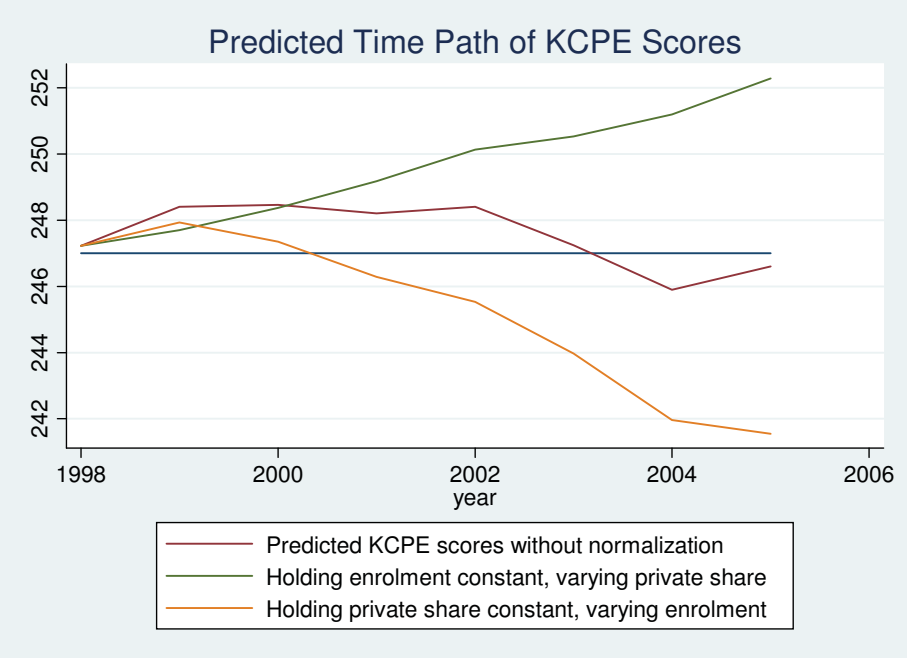


Figure 5: Predicted national average KCPE scores based on the regression coefficients in column 4 of Table (7).

Table 6: Achievement: Summary Statistics for KCPE Exams

	Average Score				Pupils Sitting Exam			
	All	Gov't	Priv	Priv Premium	All	Gov't	Priv	Priv Share
1998	247	245	281	14.7%	441,742	420,406	21,336	4.8%
1999	247	245	286	16.7%	450,030	426,486	23,544	5.2%
2000	247	245	288	17.6%	475,951	449,255	26,696	5.6%
2001	247	244	291	19.3%	509,325	476,988	32,337	6.3%
2002	247	244	291	19.3%	534,865	495,757	39,108	7.3%
2003	247	243	297	22.2%	583,439	539,175	44,264	7.6%
2004	247	243	297	22.2%	652,224	598,649	53,575	8.2%
2005	247	243	290	19.3%	665,644	600,767	64,877	9.7%

Averages scores are based on school-level data, weighted by the number of pupils sitting the exam in each school. Scores are re-based each year so that the national average is constant. This re-basing preserves changes in relative performance between sub-groups of test takers, e.g., between sexes, public and private schools, and districts. The between-school standard deviation in KCPE scores was relatively stable over the period, ranging from 40 to 42 overall, 36-39 for government schools, and 51-57 for private schools.

We distinguished various potential avenues linking FPE to a deterioration in public school quality. Estimates of our enrolment model in Section (5) suggest that the increase in the number of students in public schools, and the decrease in the average socio-economic composition of public school students, contributed to the "flight" of middle- and upper-income households to the private system. However, the residual change in demand for public schools, after controlling for changes in size and composition, is positive. Thus we find no evidence of a decline in the underlying quality of public schools once class size and composition effects are controlled for, anecdotes of a decline in parental involvement and a loss of local accountability notwithstanding.

In terms of academic achievement, we find relatively little change. The influx of lower-income students did place significant downward pressure on performance in public schools. However, the somewhat ironic conclusion of our analysis is that FPE contributed to a countervailing increase in national

Table 7: Achievement: Determinants of Examination Scores

	(1)	(2)
Private school share	103.2	89.1
	(19.7)***	(22.4)***
Private school share sq.		42.2
		(97.9)
Total enrolment	-3.7	-2.3
	(.8)***	(1.8)
Total enrolment sq.		-.07
		(.09)
Constant	261.7	257.1
	(4.2)***	(6.4)***
District-gender fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Obs.	976	976

Each column represents a separate regression. The unit of observation is a district-gender-year cell. The dependent variable is the average KCPE examination score for all pupils of a given gender in a given district in a given year, lumping together both public and private schools. "Total enrolment" is the total number of children taking the KCPE exam in the district-gender-year cell, measured in '000s, and "Private school share" reflects the proportion of these students who are enrolled in private schools.

performance on primary-leaving exams by encouraging a shift in enrolment from low-performing public to high-performing private schools. Our estimates, robust to self-selection of students into schools based on wealth or unobserved ability, suggest that private schools yield scores that are roughly two and a half standard deviations higher than government schools.

Despite the erosion of public school quality and the shift in demand toward the private sector, we caution that our findings should not be interpreted as indicating that FPE has "failed". Again, as we document in Section (5), FPE has been successful in opening education access to the poorest segment of Kenyan households, and narrowing the enrolment gap between expenditure quintiles. Furthermore, our results are reassuring in the sense that we find no evidence that free schooling, for a given composition of students, is necessarily of lower quality. While local accountability in Kenyan public schools may be weak overall, as evinced by high teacher absenteeism for instance, there is no evidence from our analysis that charging fees is the key to solving these problems.

At present, Kenyan private schools appear quite cost effective relative to public schools: we estimate a very large, positive effect on test scores from moving from public to private primary schooling, despite the fact that a majority of pupils in the private system pay fees less than public-school funding levels per pupil under FPE. However, at least two points should restrain any simple translation of these results into policy. First, because private schools charge fees, reliance on the private system may lead to sub-optimal levels of investment in human capital accumulation by parents. Research on educational spending by poor households (Abhijit Banerjee & Esther Duflo 2007) and evidence of pupils' systematic under-estimation of the returns to education (Robert Jensen 2010) both suggest a key role of public subsidy for primary schooling as seen under FPE. Second, the success of Kenyan private schools is closely linked to the labor market distortions created by the public school system. Large public-sector wage premia encourage young, un-

employed teachers to teach for low wages in the private sector as a stepping stone into the civil service. Any speculation about 'scaling up' the success of private schools documented here must bear this institutional context in mind.

Nevertheless, the ability of the private school system to absorb hundreds of thousands of new students in the wake of FPE and significantly increase their scores poses a serious challenge for the public system. The task of constructing institutional mechanisms within the FPE framework to provide the same quality of education for the poorest students that is available for a fee in the private system remains unfinished business. A growing body of experimental work in Western Kenya summarized by Kremer (2003), and in particular the menu of organizational interventions evaluated by Duflo, Dupas and Kremer (2009*a*, 2009*b*), points the way on this front. In ongoing research we investigate the impact of incorporating the lessons from these small-scale evaluations into national policymaking as part of FPE.

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