The Role of Secondary Education Tuition Fees in Enrollment Behavior in Malawi

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Abstract

This study employs a regression discontinuity design to estimate the impact of tuition fees on secondary school enrollment in Malawi. We provide evidence that tuition fees act as a significant barrier to enrollment at the secondary school level. Moreover, we estimate that enrollment is about 17.5-20.2 percentage points (33,602-38,756 students in 2011) lower than it would have been if tuition were free. The total cost of subsidizing secondary tuition is approximately 16.04 million USD in the first year of implementation, and increases in each subsequent year to a total of 73.48 millions USD after four years.

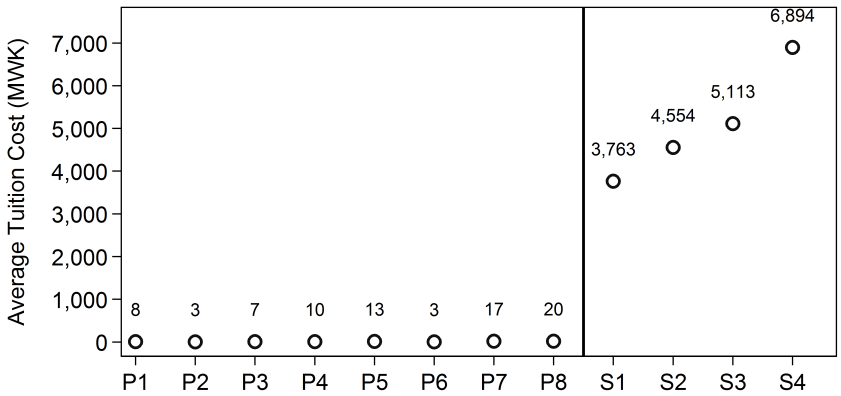
1 Introduction

Education has long been viewed by social scientists as a means to increase human capital accumulation, learn and acquire skills, shape individual behavior, as well as improve upon one's health status (Becker, 1993; Haveman and Wolfe, 1984; Ross and Wu, 1995). Education also plays a central role in enabling development through a more productive, healthier, and more socially cohesive population (Haveman and Wolfe, 1984; Psacharopoulos and Woodhall, 1993). Recent evidence supporting this argument presented in Peet et al. (2015) shows that returns to education among African countries are around 10 percent per additional year of schooling. De Neve et al. (2015) find that an additional year of secondary schooling in Botswana lowers the risk of HIV infection by 8 percent.

This paper evaluates the extent to which tuition fees in secondary school act as an entry barrier for children who otherwise, in a state of the world where tuition fees are free, would have enrolled in secondary school in Malawi. Although Malawi provides primary education at virtually no cost, secondary education is not free (Al-Samarrai and Zaman, 2007; Otach, 2008). Average household expenditures on tuition fees is about 20 Kwacha (0.13 USD) in eighth primary and 3,763 Kwacha (25 USD) in the first secondary. This research provides evidence on the severity of tuition fees as barriers to enrollment and progress to secondary education among eligible children. In addition, we provide estimates of the monetary costs associated with implementing universal secondary education in Malawi as they are weighted against the potential benefits of said policy.

The tuition fees structure in Malawi creates a natural gap in average tuition expenses in the transition period between primary and secondary grade level (Figure 1). We employ a regression discontinuity design to identify the effect of a non-negligible increase in tuition from primary to secondary school on the likelihood of secondary school attendance. We find evidence that the presence of tuition fees at the secondary level significantly lowers secondary school attendance rates among eligible children in Malawi.

Figure 1: Expected Tuition Costs, by Grade Level



2 Data and Empirical Strategy

We employ a regression discontinuity (RD) design to identify the effect of tuition fess on grade progression from primary to secondary school. The RD strategy enables us to estimate a counterfactual response to a substantial increase in tuition fees. Specifically, we isolate the decision whether to continue a child's education when facing an increase in the expected cost of school attendance. In Malawi, children, or the household decision maker, face a significant budget constraint when deciding whether their child should attend secondary school, whereas the budget constraint is much lower in primary school.

We identify the effect of tuition by comparing attendance decisions between children who are deciding whether to attend school in the following academic year and facing a substantial increase in tuition fees to similar children in a similar position but not facing an increase in tuition. Formally, we identify the effect of tuition on grade progression as follows:

$$P(Y_{it}|X, \mu_d) = \alpha Treat_i + X\beta + \mu_d + \varepsilon_{it} \tag{1}$$

where the treatment is assigned according to the following rule:

$$Treat_i = \begin{cases} 1 & \text{if } E[C_{d,t-1}] > 0 \\ 0 & \text{if } E[C_{d,t-1}] = 0 \end{cases} \tag{2}$$

$P(Y_i t|X, \mu_d)$ is the probability that individual i progresses to secondary school from primary in time period t. $Treat_i$ takes on a value of 1 if student i is currently in eighth grade and facing an expected increase in tuition in first secondary in period $t + 1$, and zero if the student is currently in seventh primary facing no expected change in tuition heading into eighth primary. X denotes a matrix of observable demographic characteristics for each student including age, gender, parents' education, religion, and home language. Lastly, μ_d represents subnational district level fixed effects to account for regional differences in school attendance behavior and $\varepsilon_i t$ denotes the idiosyncratic error term.

Students on either side of the tuition cutoff must be similar along their observable characteristics (X) for the RD design to yield causal estimates of tuition on grade progression (Imbens and Lemieux, 2008; Lee and Lemieuxa, 2010). In other words, the only discrete jumps along the running variable should be in the treatment assignment factor and nothing else, thus isolating the treatment effect from other potential confounders.

We draw the original analytic sample from the Living Standards Measurement Survey (LSMS) administered by the World Bank in Malawi in 2010. The sample includes students in both the treatment group (students who will be facing secondary school tuition fees in $t + 1$) and the

control group (students who will still be facing primary school tuition fees). At face value, the two groups are similar most of their observable characteristics except for their average age and whether the father is educated. However, we cannot rule out the possibility of differences in the confounding factors because the LSMS data show that although there is significant overlap in the distributions of observed factors between the treatment and control groups (Table 1).

To address the imbalance in the samples, we employ a one-to-one propensity score matching algorithm to achieve sample balance on both sides of the expected tuition fee discontinuity. Table 2 displays the differences in means for the matched treatment and control groups. Propensity score matching yields a final analytic sample of 1,158 children from the original sample of 1,503. The table shows that we are able to achieve a balanced sample thus satisfying the main condition for the RD design to yield causal estimates.

Table 1: Mean differences in observed characteristics, by treatment status

	Treat	Control	(T - C)
Demographics:			
Age in years	16.10	15.57	0.533*
Female	0.546	0.509	0.037
Father not educated	0.581	0.657	−0.075*
Mother not educated	0.805	0.830	−0.025
Religion:			
Christian	0.882	0.897	−0.016
Home language:			
Chewa	0.529	0.528	0.001
Lomwe	0.041	0.055	−0.013
Nyanja	0.071	0.042	0.028*
Tumbuka	0.153	0.163	−0.010
Yao	0.076	0.070	0.006
Observations	**640**	**863**	

Notes: Difference is calculated as $\mu_{treat} - \mu_{control}$. Mean differences are tested for statistical significance using a simple t-test.

Other considerations for the RD design that may yield biases in our estimated treatment effect include differences in the difficulty in progression from primary to secondary school relative to progression from seventh to eighth primary. It is straight forward to argue that students currently in seventh primary may have an easier path to progression than students currently in eighth primary as there may be differences in the level of academic rigor between the two grades. However, to mitigate this concern, we argue that the level of academic difficulty is similar between the two grades, relative to its corresponding student populations. The World Bank reports a pass rate of 74.9 percent on the Primary School Leaving Certificate Exam (PSLCE), which is administered in eighth primary. This is roughly similar to the progression rate from seventh to eighth primary, at 80 percent. This means that the proportion of students in the treatment and control groups who are eligible for the following grade level are roughly equivalent.

Table 2: Mean differences in observed characteristics, by matched groups

	Treat	Control	(T - C)
Demographics:			
Age in years	15.98	16.03	−0.05
Female	0.541	0.522	0.019
Father not educated	0.626	0.623	0.002
Mother not educated	0.812	0.835	−0.022
Religion:			
Christian	0.888	0.873	0.015
Home language:			
Chewa	0.52	0.556	−0.036
Lomwe	0.046	0.044	0.001
Nyanja	0.05	0.049	0.001
Tumbuka	0.168	0.152	0.016
Yao	0.075	0.079	−0.004
Observations	**579**	**579**	

Notes: Difference is calculated as $\mu_{treat} - \mu_{control}$. Mean differences are tested for statistical significance using a simple t-test. One-to-one matching created using propensity scores, via logit model and 0.2 caliper.

Another concern with our empirical strategy is the relatively lower access to and/or supply of secondary schools to satisfy the demand for secondary education (Lewin, 2009). Table 3 shows that the supply of schools is higher at the secondary school level than at the primary level, relative to the number of students served. From the table, we can see that the pupil-to-teacher ratios in primary school are between double and quadruple the same ratios in secondary schools suggesting that an potential sudden increase in secondary school enrollment can be absorbed by the current infrastructure.

Moreover, if we assume that secondary schools are able to sustain pupil-teacher ratios similar to primary schools, then they may be able to absorb between a doubling and a quadrupling of student enrollments without incurring additional human or physical capital expenditures. To clarify, physical and human capital expenditures would include new classroom construction, school supplies, and hiring and training new teachers. However, it is likely that educating secondary school students is more costly than primary school students. At minimum we are able to show that current secondary school resources are able to absorb some increase in enrollment without substantially affecting their overall operational costs.

3 Results

Naive descriptive analyses show a sharp decline in progression rates in the transition from eighth primary to first secondary grade, from 80.4 percent to 61.5 percent. On the other hand, the

Table 3: Supply of schools and teachers, by district

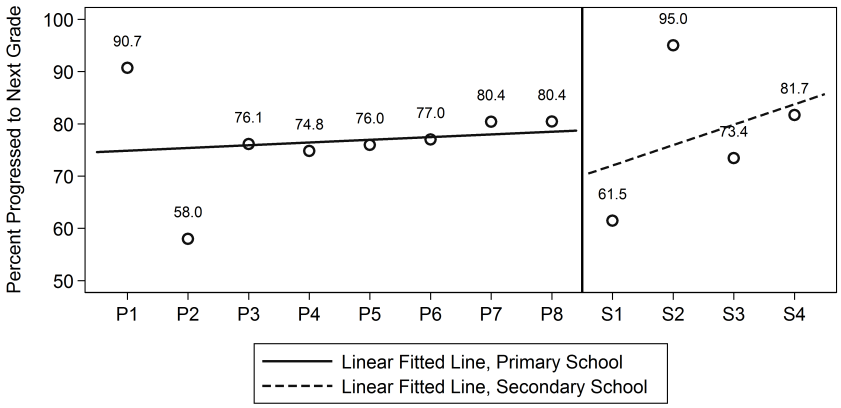
	Primary		**Secondary**	
District	Pupil-to-School	Pupil-to-Teacher	Pupil-to-School	Pupil-to-Teacher
Balaka	712	75	223	20
Blantyre	1300	71	327	18
Chikwawa	789	82	250	22
Chiradzulu	1098	65	234	24
Chitipa	416	65	238	26
Dedza	806	76	250	25
Dowa	766	75	257	24
Karonga	594	72	216	23
Kasungu	667	81	257	25
Lilongwe	1077	69	304	23
Machinga	961	86	273	25
Mangochi	847	83	218	20
Mchinji	751	76	311	27
Mulanje	1061	79	293	23
Mwanza	696	60	281	28
Mzimba	695	68	216	21
Nkhata Bay	431	64	173	27
Nkhotakota	696	75	290	27
Nsanje	748	68	246	20
Ntcheu	670	71	290	23
Ntchisi	551	70	321	26
Phalombe	1280	76	273	22
Rumphi	369	58	227	21
Salima	757	69	222	16
Thyolo	1012	79	275	26
Zomba	1077	67	337	19

Notes: Data are derived from the 2012 Education Management Information System statistical report prepared by Ministry of Education Science and Technology in Malawi.

progression rates from third through eighth primary are somewhat stationary fluctuating within 6 percentage points across all grades, between 74.8 and 80.4 percent. Given the level of similarity between students in seventh and eighth primary, we argue that the differences in progression rates are due to the expected tuition in the subsequent academic year.

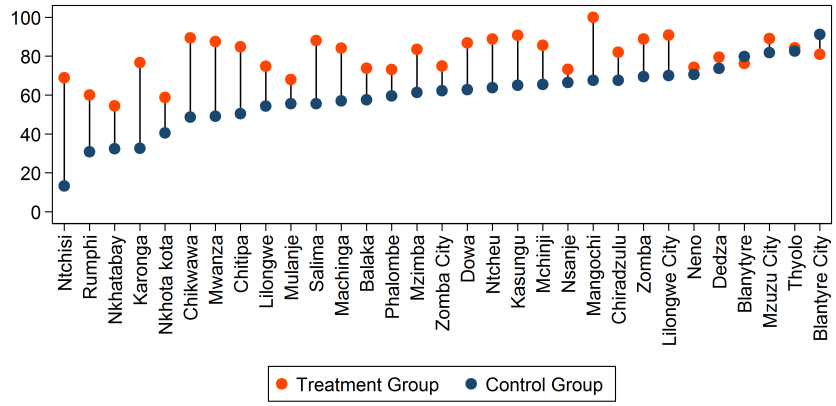
We disaggregate the gap in grade progression between students in the treatment and control groups at the district level to confirm whether the treatment effect is heterogeneous by subnational region. We find that progression rates are higher for students facing an expect tuition fee of zero relative to those facing an expected tuition fee greater than zero in the next academic year across all but two districts. Moreover, we can see that the gap in grade progression rates varies between districts. As such, it is important to include district level controls in our subsequent regression analyses to identify the effect of a change in tuition fees on secondary school

Figure 2: Grade Progression, by Grade Level



attendance.

Figure 3: Grade Progression, by Grade Level



Finally, we present the naive RD regression results for the full sample, the full sample with control variables, and the matched sample with control variables in Table 3. We find that our estimates are neither sensitive to the analytic sample chosen nor the inclusion of control variables, meaning that the RD regression model is not misspecified.

Table 4 shows that, across all specifications, completely lowering tuition fees from 3,763 Kwacha (expected tuition in first secondary) to 20 Kwacha (expected tuition in eighth primary) increases the likelihood of progression to first secondary by between 17.5 and 20.2 percentage points. Relative to the mean progression rate, lowering secondary education tuition fees increases grade progression by between 28.5 and 32.8 percent. Further, we find that the effect of lowering tuition fees varies between genders. Eliminating tuition fees in secondary school raises progression to secondary school by between 24.5 and 26.5 percentage points for male students (39.8 and 43.1 percent, relative to the mean), and between 11.7 and 16.1 percentage points for females (19 and 26.2 percent, relative to the mean). We note that although the effect on males is larger in

Table 4: RD results, probability of progression to next grade level

	[1]	[2]	[3]
Full Sample:			
Treatment Effect	0.175*	0.190*	0.202*
	−0.027	−0.028	−0.031
Female Sample:			
Treatment Effect	0.117*	0.135*	0.161*
	−0.036	−0.036	−0.038
Male Sample:			
Treatment Effect	0.245*	0.255*	0.265*
	−0.041	−0.042	−0.048
Student Controls	No	Yes	Yes
Matched Sample	No	No	Yes

Notes: All specifications include district level fixed effects. Numbers in parentheses denote robust standard errors. Asterisks denote statistical significance as follows. * p<0.01

magnitude, the effect is in fact equalizing. For instance, the predicted progression rate for males would increase from 57.1 percent to 81.6 percent while the predicted progression rate for females increases from 68.3 to 80 percent–in other words, the gender parity ratio (male-to-female) based on progression rates changes from 83.7 (out of 100) to 102 (out of 100).

4 Policy Simulation and Discussion

In this section, we compute the potential effects of eliminating tuition fees in secondary school on enrollment in secondary grade levels on mean years of schooling for one cohort of students. In addition, we estimate the total cost of the government eliminating tuition fees. Table 5 displays the counterfactual distribution of grade attainment because of the policy among females, males, and overall for one cohort of eighth primary students. Additionally, we compute the mean years of schooling under the counterfactual scenario and the gains over and above the observed mean years of schooling for the same cohort. Overall, we estimate that 38,786 students will have a higher level of attainment under the hypothetical policy that eliminates tuition fees, 22,096 of whom will attain at least the final year of secondary school.

We estimate that the implementation of a policy that eliminates secondary school tuition fees increases education attainment by 0.42 years for females, 0.89 years for males, and 0.65 years overall. These estimated effects are in line with estimates from (deneve2015) using data from Botswana, who find an increase in mean years of schooling by 0.64, 1.01, and 0.79 years for females, males, and overall, respectively. Further, these estimates are used to infer that each additional year of secondary schooling leads to a 5-11.6 percent decrease in HIV prevalence.

Table 5: Actual and counterfactual grade attainment and mean gains in years of schooling, by gender

	Actual	Counterfactual	Change
		Female	
Cohort size		100,316	
Primary 8	35,779	21,292	-14,487
Secondary 1	3,762	4,730	968
Secondary 2	19,559	24,694	5,135
Secondary 3	8,448	10,392	1,944
Secondary 4	32,768	39,208	6,440
Years of Schooling	9.99	10.41	0.42
		Male	
Cohort size		91,694	
Primary 8	38,145	13,846	-24,299
Secondary 1	2,142	3,114	972
Secondary 2	10,281	14,947	4,666
Secondary 3	6,621	9,626	3,005
Secondary 4	34,505	50,161	15,656
Years of Schooling	9.97	10.86	0.89
		Overall	
Cohort size		192,010	
Primary 8	73,924	35,138	-38,786
Secondary 1	5,904	7,844	1,940
Secondary 2	29,840	39,641	9,801
Secondary 3	15,069	20,018	4,949
Secondary 4	67,273	89,369	22,096
Years of Schooling	9.98	10.63	0.65

Notes: Counterfactual progression rates from primary 8 to secondary 1 are based on estimates of model [3] in Table 3. All other progression rates are based on the empirical rates based on the LSMS data.

To finance the tuition subsidy to the cohort of would be secondary students who are affected by the policy would cost between 15.8 and 16.3 million USD for one cohort of eighth primary students. Additionally, the cost to the government, without subsidizing tuition, of educating secondary school children will now be between 42.5 and 43.9 million USD. Factoring in the tuition subsidy will increase total government spending secondary education to between 58.2 and 60.2 million USD.

Table 6: Total cost of providing free secondary education for one cohort

Secondary grade	Tuition per student	[1]	[2]	[3]
Year 1	$25.09	151,688	154,568	156,872
Year 2	$30.36	144,104	146,840	149,028
Year 3	$34.09	105,772	107,781	109,387
Year 4	$45.96	86,416	88,057	89,369
	Tuition cost over 4 years	$15.8M	$16.1M	$16.3M
	Public spending over 4 years	$42.5M	$43.3M	$43.9M
	Total	$58.2M	$59.3M	$60.2M

Notes: Tuition per student are presented in 2010 USD. There are a total number of 192,010 primary 8 students. Numbers in Year and Model combinations denote the number of primary 8 students who progressed to secondary year 1 through 4. Tuition and government costs are summed across all 4 years of secondary school.

Next, we compute the financial cost of eliminating secondary tuition fees on students currently attending eighth primary for each year of secondary school and overall. In the first year of implementation, eliminating tuition in secondary education would cost 16.04 million USD, 19.81 million USD in the second year,, 18.41 million USD in the third year, and 19.22 million USD in the fourth year after all unaffected cohorts would have exited the public education system. We calculate the number of students in each grade level in each year post-policy by incorporating the known secondary school progression and retention rates. Each grade includes students who are first time entrants as well as repeaters to compute the total cost of eliminating tuition in secondary school.

After the first year of the policy, we observe a permanent increase in total secondary school enrollment as a result of permanently lowering the barrier to entry to secondary education. As a final step, we estimate additional capital and recurrent expenditures required to meet the added demand at the secondary level, resulting from the elimination of tuition fees. note that if existing secondary schools can sustain providing education with ratios similar to those prevalent in primary schools, then the estimated increase in secondary enrollment may be completely absorbed without teacher and classroom costs.

Table 7 presents the additional number of teachers, classrooms and schools that would be necessary to accommodate increased demand for secondary education, assuming a constant ration with pupils. With this assumption, we project an upper bound on the total costs of the hy-

pothetical subsidy discussed in this paper. Estimates are provided for each of the regression specifications outlined in Table 4.

Table 7: Additional secondary teachers and education resources projected to meet demand

Ratio of pupils to...		[1]	[2]	[3]
Teachers	22	2,338	2,535	2,691
Classrooms	49	1,049	1,137	1,207
Schools	259	199	216	229

Notes: Additional resources are calculated as the difference between current resource inputs and what would be needed to meet additional demand. Data are drawn from Malawi Ministry of Education Science and Technology (EMIS, 2012).

Depending on the regression specification, the number of additional teachers required to meet demand would be between 2,338 and 2,691, and the number of additional classrooms needed would be between 1,049 and 1,207. We do not project the number of additional schools that would need to be built, we assume that existing schools may expand using available land. The total additional cost to the government of eliminating tuition fees in secondary school including loss of tuition fees, increase in total teacher salaries paid, training new teachers, and additional classrooms constructed is shown in Table 8. We present the overall costs for the first four years of the program.

Table 8: Estimated additional cost of eliminating tuition fees for the first four years of implementation

	Year 1	Year 2	Year 3	Year 4
Secondary 1	159,398	185,983	168,134	162,047
Secondary 2	130,132	178,535	160,949	161,954
Secondary 3	101,394	116,195	123,170	123,592
Secondary 4	100,940	125,422	111,052	131,028
Total	**491,865**	**606,135**	**563,305**	**578,621**
Student cost	\$16.0M	\$19.8M	\$18.4M	\$19.2M
Teacher salary	\$5.49M	\$5.49M	\$5.49M	\$5.49M
Teacher training	\$0.47M	–	–	–
Class construction	\$10.2M	–	–	–
Total cost	**\$32.19**	**\$25.30**	**\$23.90**	**\$24.71**

Notes: Numbers in each cell represent the total number of students in each secondary grade level in each year of implementation. This includes cohorts who are directly affected by the policy and students already in secondary school after the policy takes effect. Teacher and classroom costs are estimated from World Bank (2010).

In total, the elimination of school fees at the secondary level and corresponding increase in

demand would cost the Government of Malawi an estimated 106.1 million USD over the first four years of implementing the policy that yields an overall increase in secondary school attendance rates by about 34 percent. That is, it would cost between 2,738 and 3,158 USD per child to enroll in secondary school and progress toward secondary school completion at the national rate.

References

Al-Samarrai, S. and H. Zaman (2007). Abolishing school fees in malawi: The impact on education access and equity. *Education Economics 15*(3), 359–375.

Becker, G. (1993). *Human Capital: A theoretical and empirical approach with special references to education*. Chicago: University of Chicago.

De Neve, J.-W., G. Fink, S. Subramanian, S. Moyo, and J. Bor (2015). Length of secondary schooling and risk of hiv infection in botswana: evidence from a natural experiment. *The Lancet Global Health 3*(8), 470–477.

Haveman, R. H. and B. L. Wolfe (1984). Schooling and economic well-being: The role of nonmarket effects. *Journal of Human Resources 19*(3), 377–407.

Imbens, G. W. and T. Lemieux (2008). Regression discontinuity designs: A guide to practice. *Journal of Econometrics 142*(2), 615–635.

Lee, D. S. and T. Lemieuxa (2010). Regression discontinuity designs in economics. *Journal of Economic Literature 48*(2), 281–355.

Lewin, K. M. (2009). Access to education in sub-saharan africa: Patterns, problems and possibilities. *Comparative Education 45*(2), 151–174.

Otach, O. (2008). *Abolishing school fees in Africa: Lessons from Ethiopia, Ghana, Kenya, Malawi, and Mozambique*. Washington, DC: The World Bank.

Peet, E. D., G. Fink, and W. Fawzi (2015). Returns to education in developing countries: Evidence from the living standards and measurement study surveys. *Economics of Education Review 49*, 69–90.

Psacharopoulos, G. and M. Woodhall (1993). *Education for development*. Oxford University Press.

Ross, C. E. and C.-l. Wu (1995). The links between education and health. *American Sociological Review 60*(5), 719–745.

World Bank (2010). *The Education System in Malawi*. Washington, DC: The World Bank.