CHAPTER 3

Drivers of Performance

Johannes Hoogeveen, Mariacristina Rossi and Dario Sansone

Abstract This chapter uses the annual school census to analyze differences in primary school performances across regions. Our results, obtained from a stochastic frontier analysis, suggest that differences in efficiency explain only part of the observed variation, while resource availability is the most important driver of performance differences. In addition to this, we note that resources are distributed quite unevenly among regions and schools. By distributing more school inputs, or distributing existing inputs more equally to the benefit of underserved schools, performance can be expected to go up.

Keywords School census · Stochastic frontier analysis · Performance drivers · Regional difference · Scholastic inputs

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3.1 Introduction and Motivation

As highlighted in the second chapter, Togo undeniably achieved improvements in the enrollment of primary school children. Through the combined effect of the introduction of free primary education and the absorption of community schools in the public school system, the number of students enrolled in public primary schools increased from less than 600,000 in 2006/2007 to about one million five years later. Over the same period the number of public schools increased from 3783 to 4593 and the number of classrooms from 16,538 to 23,615.

Despite the progress made, learning assessments like those done by PASEC suggest the primary education system faces important challenges in terms of education quality, with respect to regional differences in attendance (much lower in Savanes for instance) and the distribution of school inputs. This chapter aims at understanding the role school inputs play as drivers of school performance. It does so by carrying out a frontier analysis. School performance data have been drawn from administrative data on learning assessments. Specifically, we use primary school pass rates for every primary school in the country, for the 2010/2011 academic year.[1] These data are then combined with information on inputs, equally obtained for every school for the same school year. The first part of the analysis examines whether input quantities, versus inefficiency in input usage, explain differences in school outcomes. The analysis is then enriched by considering nonschool aspects, and uses *Questionnaire des Indicateurs de Base du Bien-être* (QUIBB) survey household data to assess drivers of enrollment within households.

The main contribution of this chapter is that it offers additional empirical evidence to organize the debate about resource vs. inefficiency in educational systems. Scholars have often pointed to teacher absenteeism as a main source of inefficiency and a main cause behind the dismal learning outcomes in some low- and middle-income countries. For instance, Ravallion (2016) highlighted the extremely low levels of actual teaching in India (Probe Team 1999, 2011) as well as in several other

[1] The analysis in this chapter focuses on the 2010/2011 school year as this is the year for which complete dataset for all schools could be obtained. Since that time investments have been made to improve the availability of school inputs, as evidenced in the previous chapter. Still as Chapter 2 demonstrates many schools and regions remain underserved, so that the assessment of this chapter remains relevant.

countries (World Bank 2004). Teacher absenteeism has also been discussed, among the others, by Kremer et al. (2005), Banerjee and Duflo (2006), Chaudhury et al. (2006), and Duflo et al. (2012). As a result, many researchers have focused their effort to analyze how to provide stronger incentives to teachers (Glewwe et al. 2010). Similarly, school and teacher autonomy have been extensively discussed in Woessmann (2003), Fuchs and Woessmann (2007), and Hanushek et al. (2013).

This chapter finds that, while it is true that inefficiencies are widespread and substantial, school resources are key determinants of educational outcomes. In other words, while it is true that reducing inefficiency may improve student performance, it is important not to forget that much basic infrastructure is simply lacking. This result is in line with the role of school inputs emphasized in Angrist and Lavy (1999), Case and Deaton (1999), and Krueger (1999). The evidence from our analysis of the school census suggests that gains brought about by increasing efficiency may be marginal compared to the huge potential benefits of additional school inputs. Students cannot learn without textbooks, blackboards and toilets.

3.2 Scholastic Inputs, Efficiency and Performance

By the 2010/2011 school year the primary cycle was in the midst of recovering from the combined shock of Togo's the economic and crisis which had lasted almost a decade and a half, the introduction of free universal education in 2008/2009 and the absorption of locally funded schools EDIL schools into the public system. Consequently, the fraction of children attending public schools has increased from 58% in 2006/2007 to 72% in 2011/2012 and total enrollment in public primary schools has gone up from around 600,000 in 2006/2007 to over 1,000,000 students in 2011/2012, an increase by 66% (Fig. 3.1).

Despite this increase in enrollment, primary school enrollment remains far from universal. According to the 2011 QUIBB, only about 82% of eligible children attend a primary school. Among children aged 6–11 who do not attend primary school, those from the poorest households are over-represented: 38% of children who do not go to school come from the poorest households, whereas only 6% come from a household in the top wealth quintile.

Another challenge facing the school system in 2010/2011 was the presence of large regional inequalities in almost every aspect and at

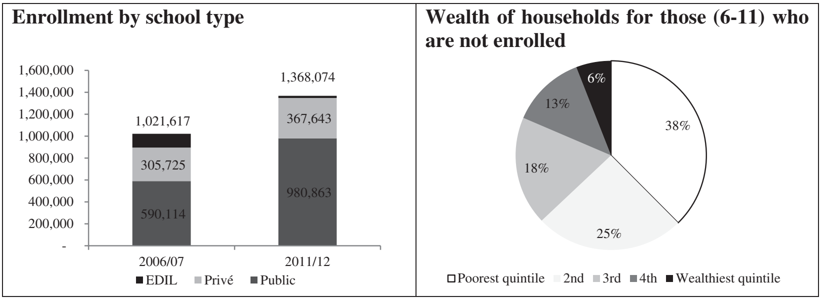

Fig. 3.1 Primary school enrollment inequalities (*Source* Authors' calculations based on the Ministry of Education 2010/2011 EMIS Data Base and QUIBB 2011)

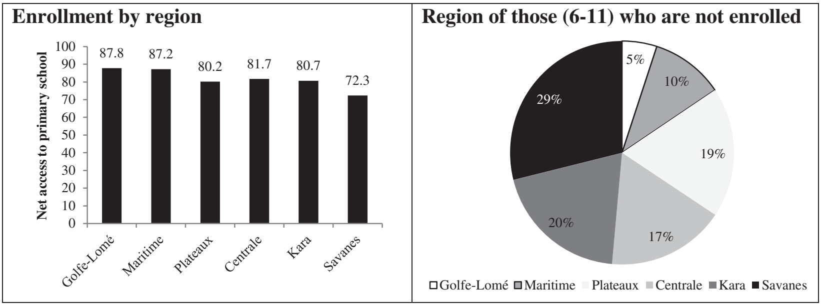

Fig. 3.2 Primary school enrollment (*Source* Authors' calculations based on QUIBB 2011)

almost every level. The further north one goes, the worse the results are. The Savanes region, in the upper north of the country is often the worst off, while the coastal regions Golfe-Lomé and Maritime are typically the best off. This gap can be illustrated with school access: the average enrollment rate in Togo is 82%, but this rate increases up to 87% in the coastal regions, whereas in Savanes it is only 72%. Almost a third of the children aged 6–11 who are not enrolled in a primary school can be found in Savanes, even though only 12% of the Togolese population resides there (Fig. 3.2).

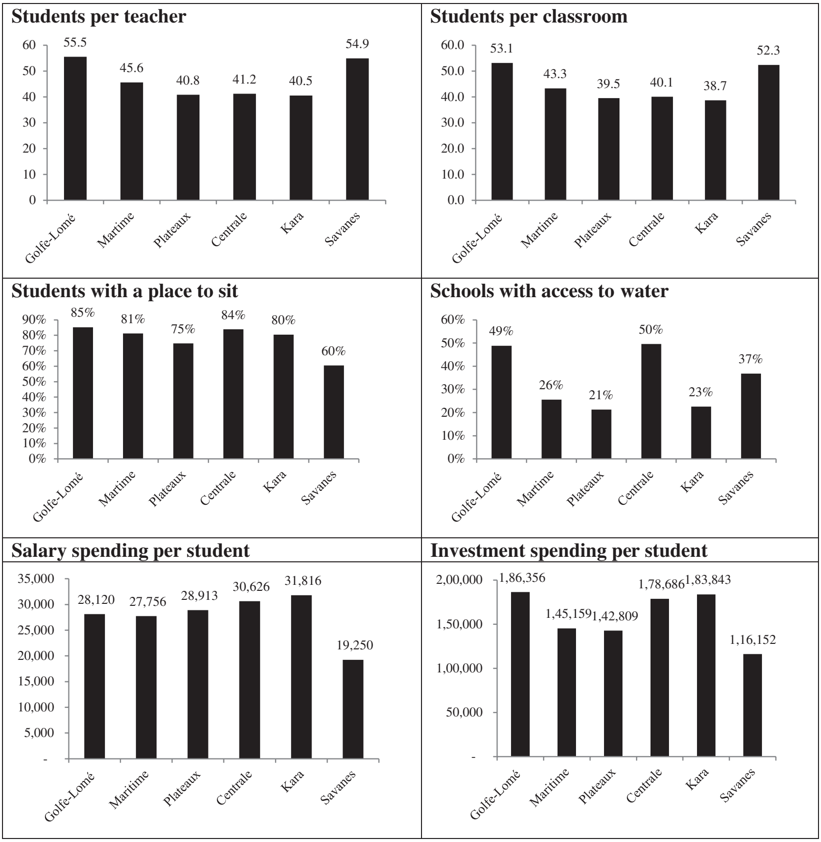

Fig. 3.3 School characteristics: 2010–2011 (*Source* Authors' calculations based on Ministry of Education 2010/2011 EMIS Data Base)

As shown in Fig. 3.3, these stark gaps are reflected in differences in scholastic inputs. The number of students per teacher varies from around 40 in Kara to over 55 in Golfe-Lomé and Savanes. In Plateaux the average number of students per classroom is 40; in Golfe-Lomé is 53. In Savanes, only 60% of students sit at a desk; in Golfe-Lomé, 85% of students do so. In Plateaux, only 21% of schools have access to water; in Golfe-Lomé and Central, about half the schools have such access. In terms of spending, the differences are equally striking. Salary spending per student (taking into account differences in payments for different type of staff) in Savanes is 60% of that in Kara. The same holds for the total amount spent on investments. Considering the total outlays for buildings, toilets, desks and chairs, spending per student in Savanes is around CFAF 116,000, while for students in Kara 60% more had been spent CFAF 183,000.

At the prefecture, or at the school level, inequalities are even more pronounced. This can be illustrated with the number of students per classroom. At the national level, the average for public schools is 43 students per class, but at the regional level this varies from 39 to 53 students per class. At the prefecture level, the range goes from as low as 16 students per class to as much as 103. It is hard to imagine that this kind of variability is an efficient way of allocating resources. Cantons where the number of students is only 16 per classroom have too many classrooms (or too few students). Cantons with more than a hundred students per classroom may have so many students in a classroom that it becomes plausible that very little learning takes place, implying that most education spending may be wasted.

Another way to demonstrate the relation between adequate scholastic inputs, efficiency and performance is by exploring the relation between outcomes and spending. The performance measure that we have selected is the number of students that were admitted to participate in the primary school leaving exam (not all students in CM2, the last grade in primary school, are allowed to participate in the exam) over the total number of students in the school. Children that pass the *Certificat d'études du premier degré* (CEPD) exam are allowed to proceed to secondary school. We prefer this measure over a more direct measure (such as the fraction of students that have passed the exam) because there is a reason to suspect that schools and students behave strategically with respect to who takes and passes the exam.

This defined, one notes the existence of large differences in our performance measure (Fig. 3.4). Some cantons like Kozah in the Kara region, and Grande Lomé (GL) do well with respectively 12 and 11% of students admitted to the final exam. Others do poorly, such as Akebou in Plateaux of Kpendjal and Oti in the Savanes regions whose performance ratios are only a third of those of the aforementioned cantons (4%). Cantons in the northern region (Savanes) do particularly poorly. Beyond the fact that Centrale and Kara do better than Plateaux, with Maritime in

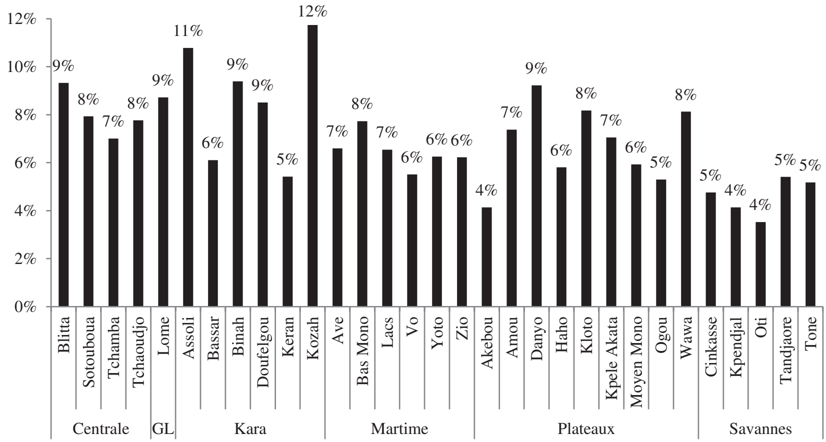

Fig. 3.4 School performance by canton in 2010/2011 (*Note* School performance is defined as the number of students that have been admitted to participating in the primary school leaving exam over the total number of students in the school. *Source* Authors' calculations based on Ministry of Education 2011/2012 EMIS Data Base)

an intermediate position, the most striking about the figure is the large degree of intra-regional variation.

On the spending side, we calculate the annual spending on teacher salaries per student, taking into account differences in grade and levels of teacher pay.[2] As spending on teachers makes up about 84% of the total primary education budget, it is a good proxy for total spending.

Figure 3.5 shows once again striking differences among regions. Indeed, if we look at payment grades for civil servants, the majority of teachers in Lomé are in grade C, while in all the other except Savanes they are mainly in grade B.

Figure 3.6 illustrates the relation between outcomes and expenditure. The graph presents for all public schools a measure of school performance (on the vertical axis) and a measure of spending (on the horizontal axis). Each dot in Fig. 3.6 represents a public school. The figure can

[2] Voluntary teacher receives about CFAF 90,000 per annum whereas a civil servant receives almost 2 million and an assistant teacher 1.3 million.

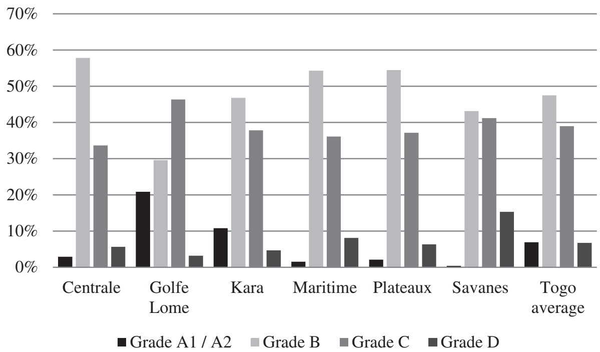

Fig. 3.5 Distribution of teachers of different grade levels by region (*Source* Government of Togo, National Yearbook of School Statistics, 2010/2011)

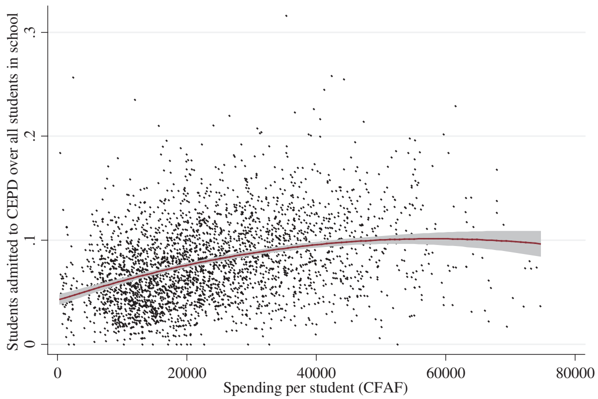

Fig. 3.6 Teacher spending per student and school performance (public schools only) (*Source* Authors' calculations)

now be used to identify those schools that do particularly well: these are the schools with the best performance for a given level of spending.

The line in Fig. 3.6 presents local averages. This line is upward sloping suggesting that more inputs (or more spending per student) lead to better results. This plot emphasizes that certain schools perform poorly given the resources they receive (those below the line do worse than average), while others (those above the line) do better than average. Excellent are those schools that lie furthest above the regression line.

This figure can also be used to demonstrate, despite not making any causality claims, that within the universe of schools in Togo there is scope for efficiency improvements through efficiency gains. Some schools receiving CFAF 20,000 per student do extremely poorly and have a performance ratio of around zero, whereas others have performance ratios higher than 0.1. By bringing the schools up to at least the average (of about 0.9) significant advances can be made without incurring additional spending.

The discussion so far has only illustrated that both inputs and efficiency matter for performance. Which of these factors matter most, and which inputs are more important, cannot be inferred from these descriptive statistics. To deepen our study, we need to turn to regression analysis, which is presented in the remainder of the chapter.

3.3 Data

The main datasets used in the regression analysis are Primary School Census data, particularly those for the 2010/2011 academic year. This dataset comprises detailed information for each school for a total of 6158 observations. Table 3.1 shows the distribution of the schools across regions: the relative majority (around 25%) is located in the Plateaux region, while the region with the smallest number of schools is Savanes. Our analysis is centered on the ratio of admitted students to the final exam of primary school (CEPD) over the total number of students in

Table 3.1 Number of schools by region

	Initial data		*Sample data*	
	Freq.	*Percent*	*Freq.*	*Percent*
Centrale	761	12.36	492	11.26
Golfe-Lomé	992	16.11	672	15.38
Kara	882	14.32	699	16.00
Maritime	1187	19.28	820	18.77
Plateaux	1595	25.90	1143	26.17
Savanes	741	12.03	542	12.41
Total	6158	100	4368	100

Source Ministry of Education 2010/2011 EMIS Data Base the school. To construct this variable, we merged the 2010/2011 and 2011/2012 school census data, since in the 2010/2011 census information about admissions to the exam was not present. Indeed, the exam results are reported in the school census the following year.

The school census data sets only present school information, but in our regression we also want to include nonschool variables as controls, such as the level of education of the population living in proximity of the school in a region. Such information is available from the poverty map that was constructed by combining the population census (*Quatrième Recensement Général de la Population et de l'Habitat*, RGPH4) of 2009 and the household survey QUIBB of 2011. It was not possible to match school level information to census or poverty map information, but at the canton level this was possible. But even then, it was not always possible to obtain a correct match and some observations were lost in this process. For instance, some schools were dropped because the total number of students admitted to CEPD was bigger than the total number of students in CM2. As a result, the number of observations used in the estimations is reduced to 4368. The last two columns of Table 3.1 display the final data, which are used in the analysis.

An overview of the main variables used in the regression can be found in the Appendix. Here we consider some of them, which are correlated to our main variable of interest: the percent of students admitted to the CEPD over the total number of students in the school. Figure 3.7

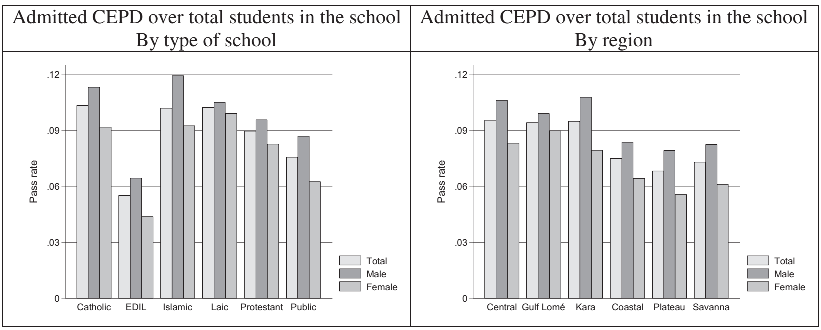

Fig. 3.7 Performance by school type and by region (*Note* Schools whose pass rate was equal to 0 have been dropped. *Source* Authors' calculations based on Ministry of Education 2010/2011 and 2011/2012 EMIS Data Base)

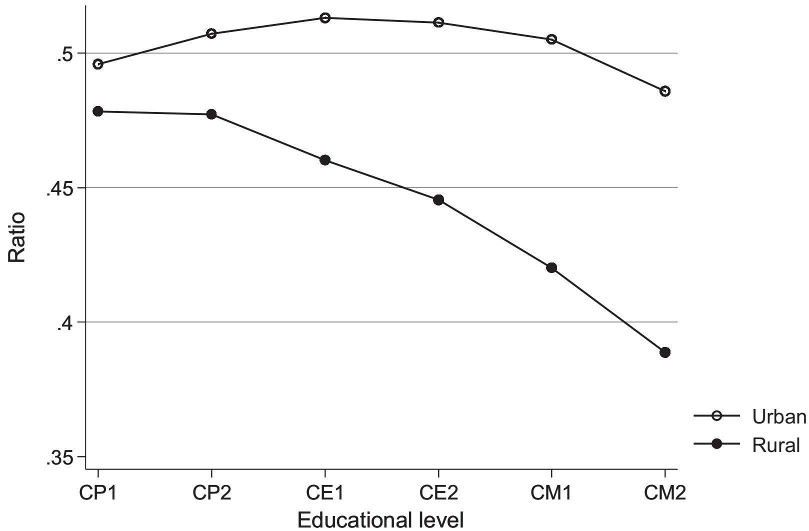

Fig. 3.8 Ratio of female over male students by grade in rural and urban areas (*Note* Male students are the complement to one of female student. *Source* Authors' calculations based on Ministry of Education 2010/2011 and 2011/2012 EMIS Data Base)

shows how schools performed on average by school type (Public, EDIL, Catholic, Islamic, Protestant and Laic) and by region. The figure shows that the best performing schools are private schools and that Kara, Lomé and Centrale are the regions with the highest levels of performance. It is also interesting to note the gender dimension of school performances, which suggests that in all regions and across all school types boys perform better than girls: this in contrast to what is generally found in non-developing countries. The difference in performance is least pronounced in Laic schools and in Lomé, and most pronounced in Community and Islamic schools.

Figure 3.8 provides further information about the gender issue: the ratio between girls in CP1, the first year of primary school and total number of students in CP1 does not differ substantially between urban and rural areas. Nevertheless, while this ratio remains roughly stable for higher educational levels in cities, there is a steady decline of female students across classes in the countryside. Indeed, in CP1 the ratio is 47.9%

(49.6% in urban areas), whereas in the last year of primary school CM2 is 38.9% (48.6% in urban areas).

3.4 Estimation Results

Table 3.2 contains the main regression result using a stochastic frontier technique.[3]

We first present our basic specification (column 1) and a richer specification in column (2). It is worth mentioning that the dependent variable is the ratio—not the percentage—of students admitted to the CEPD over the total number of students in the school. This explains why, at first sight, the coefficients in Table 3.2 have small magnitude.

Although the main aim of this chapter is to measure school inefficiency, i.e. to analyze the residuals from the frontier analysis, it is interesting to look at some of the regressors. However, it should be stressed that we cannot attach a causal interpretation to such coefficients. One of the main results is that private school show better results. This is in line with Pereira and Moreira (2007). Nevertheless, private schools are likely to be more expensive, so we should not infer from this that private schools use their resources in a more efficient way. In fact, if private schools paid their teachers better, one would expect these schools to perform better. In the absence of information on the actual cost of schools, the best we can do is to just illustrate by using a dummy variable the differences between private and public schools and note that a cost-benefit analysis would be a very useful contribution of future work. It is also worth noting that the regressions are not able to control neither for family background nor for knowledge of children at school start (i.e. kindergarten attendance). Hence, the magnitude of the private school variable

[3]The frontier technique is defined as follows: $y_i = f(x_i, ß) + v_i - u_i$ here, y_i is the output of school i, our measure of performance, $f(.)$ is a measurable production function, x_i are exogenous variables, $ß$ is a vector of unknown parameters and $v_i - u_i$ is the composed error term consisting of v, the symmetric disturbance (idiosyncratic effect), and u, the non-negative disturbance measuring the inefficiency of the school (productive inefficiency). The random errors v_i are usually assumed to be independently and identically distributed $N(0;\ \sigma_v^2)$, and independent from the u_i. The most common assumption for the inefficiency term is the half-normal distribution (Aigner et al. 1977), i.e. the non-negative truncation of the $N(0;\ \sigma_u^2)$. We use the Stata command *frontier* to perform the analysis, with the default half normal distribution in the model. We also performed the analysis by using a Tobit analysis and we also excluded thee top 255. However, the results have not changed substantially.

Table 3.2 Frontier analysis for ratio of admitted CEPD students over total students in school

	(1)	*(2)*
Private school (d)	0.014015*** (0.0013)	0.021946*** (0.0044)
Number of teachers in the school	−0.001223** (0.0004)	−0.000426 (0.0004)
Teachers-students ratio	0.002554*** (0.0005)	0.001466** (0.0005)
Female ratio in CM2	0.026710*** (0.0034)	0.022680*** (0.0033)
Average student age in CM2	−0.001066* (0.0005)	−0.000656 (0.0005)
CP1–CP2 taught together (d)	0.005535*** (0.0016)	0.004637** (0.0015)
CE1–CE2 taught together	−0.001050 (0.0016)	0.000501 (0.0015)
CM1–CM2 taught together (d)	−0.027240*** (0.0014)	−0.022625*** (0.0014)
Employment ratio	−0.000615*** (0.0001)	−0.000162* (0.0001)
Net enrollment rate—primary	0.000054 (0.0001)	0.000358*** (0.0001)
Urban (d)	0.006201*** (0.0013)	0.007130*** (0.0014)
Average qualification teachers in private school		−0.004470* (0.0018)
Ratio of permanent teachers		−0.008761*** (0.0021)
Repeating students rate		−0.056092*** (0.0044)
Ln Average teacher age		0.016199*** (0.0042)
Gender Headmaster (d)		0.008066*** (0.0018)
Average qualification teachers		0.002982** (0.0009)
Seats every 100 students		−0.000041 (0.0000)
Desks every 100 students		0.000284*** (0.0000)
Toilets every 100 student		0.001490*** (0.0004)

(continued)

Table 3.2 (continued)

	(1)	*(2)*
Water in school		−0.000092
		(0.0011)
Math books per students		0.003174
		(0.0023)
Reading books per students		0.002538
		(0.0018)
Dependency ratio		0.001847***
		(0.0001)
Enrollment rate (secondary school)		0.000363***
		(0.0001)
Constant	0.127766***	−0.112837***
lnsig2v	−6.889271***	−7.068340***
	(0.0214)	(0.0225)
lnsig2u	−16.88815	−17.02233
	(108.2370)	(63.9037)
Lambda	.006748	.006908
Observations	4368	3957

Standard errors in parentheses
$^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$

is likely to be affected by endogeneity issues, as it is likely that students from high socio-economic status self-select into private schools.

The results show that additional teachers are associated with increasing performance. On average, the pass rate is between 0.14 and 0.25 percentage points higher in schools with an additional teacher per every hundred students.

We now turn to the gender composition of the class. Given the high drop-out rate of females, we expect that a higher female to male ratio could lead to an average improvement, if the girls in school are a selected sample and are better than average students. The coefficient of female students over total students in CM2 is positive and strongly significant, thus implying also a substantial peer effect: the more numerous are the girls with respect to boys in the class, the higher is the school performance.

Older students in class do have a detrimental effect on the overall performance, but this effect holds in the most parsimonious specification only. Similarly, schools regularly merge classes, so it is important to see the effect of such a policy. Unexpectedly, if the first two years (CP1–CP2) are taught together, the effect is positive and significant. This result might signal an imitation effect that at young age, it could be beneficial for all children (in a similar vein with kindergarten). Conversely, the effect is strongly negative and significant for the last two grades (CM1–CM2), thus suggesting that classes with more than one advanced course taught simultaneously might have detrimental effects on learning. This result is very robust and corroborates the hypothesis that the learning environment is something policy-makers should focus on. Indeed, the magnitude of the last coefficient is rather high: teaching CM1–CM2 together are associated with a reduction of more than 2 percentage points in the outcome.

Employment rate in the canton in which the school is located acts as detrimental to performance, possibly because it acts as a proxy for the fact that parents have fewer opportunities to spend time with their children after school. From a geographical point of view, urban schools perform better than rural ones on average.

In the richer specification, we include additional variables, which could impact the outcome of interest. Considering the qualification of teachers, the effect is strongly significant and positive. Qualification of teachers in private schools, in contrast, gives approximately no impact, if anything. The ratio of repeating students is negatively related with the pass rate, as expected. Teacher experience (approximated by age) has a strong correlation with school performance. Furthermore, if the school headmaster is a woman, resources seem to be used more efficiently: ceteris paribus, a female headmaster is associated with an increase of around one percentage point in the pass rate.

We also add among the regressors the ratio of permanent teachers out of total teachers. One might expect that the number of permanent teachers could positively affect the overall performance. Indeed, through a selection effect, the permanent teachers should be more likely to be better teachers within an efficient recruitment system. However, the results work towards an opposite direction: the higher the ratio of permanent teachers, the lower is the school performance. We thus infer that increasing teacher quality is not correlated with hiring more permanent teachers.

In addition to this, the characteristics of the school premises do matter: desk number significantly affects the frontier as the quality of infrastructure shows an important role. The more desks are available, the higher the performance. The availability of desks has an enormous importance and, remarkably, toilets as well. An additional toilet for every hundred students has the same impact of an additional teacher. Possibly, this result could reflect better hygienic conditions, which, in turn, would turn into better health and higher performance.

We now turn our attention to the most important element of this analysis. The estimate of λ is reported at the end of Table 3.2. This parameter is defined as

$$\lambda = \frac{\sigma_u}{\sigma_v}$$

and it is not statistically different from zero. When λ goes close to $+\infty$, then all variation from the frontier is due to the inefficiency term, then it should be better to use the deterministic approach to estimate such frontier. On the other hand, if λ is close to 0—as in our case—a stochastic frontier is a more appropriate choice.

A critical result of our analysis is the low variability in the inefficiency term u_i. This implies that it is possible to distinguish between more and less efficient schools, but the key factor explaining differences in performance is the presence of inputs (and the noise component of the error term). In other words, differences in the pass rate are due mainly to lack of resources rather than technical inefficiency. We want to stress this result as it is crucial for the policy standpoint. Resources are distributed unevenly among regions and schools, and their distribution is the main driver of differences in results.

In Table 3.3, we present predicted performance by quintile of performance and the region in which the school is located. The schools requiring most attention i.e. the worst performing schools, are concentrated in Plateaux and Savanes, while few poorly performing schools are found in

Table 3.3 Predicted school performance, by quintile and region

Quintile	*Centrale*	*Lomé*	*Kara*	*Maritime*	*Plateaux*	*Savanes*	*Total*
Worst performing	4.7	0.3	12.5	17.8	42.5	22.3	100
2	9.1	9.8	16.3	16.2	30.5	18.1	100
3	11.1	17.3	13.0	21.0	27.3	10.1	100
4	16.6	22.7	14.1	15.16	22.2	9.5	100
Best performing	15.7	24.4	31.0	8.0	14.1	6.8	100
Total	11.4	14.9	17.4	15.6	27.3	13.4	100

Lomé and Centrale. The second best performers show a percentage of 10% in Savanes and the highest in Golfe-Lomé and Plateaux. Targeting poorest performing school does not mean targeting a region in particular, at least with the exception of Golfe-Lomé, where the percentage of worst performing school is negligible.

One possible concern with our empirical strategy is that individuals may move in order to gain access to a better school. First of all, it should be noted that Togo is a low-income country, thus there are high information asymmetries and parents may not know enough to judge the quality of a school. Second, in order to address this potential issue, we have looked at the data available from MICS 2010, a representative survey of the population in Togo. If parents did send their children to other family members in order to give them the opportunity to attend high-quality schools, we would observe these movements in the household composition. However, if we consider only household members aged between 5 and 12 who attended school in the academic year 2010/2011, the vast majority (almost 80%) was the household head's child. Furthermore, once we exclude orphans and children whose parents lived in the same households even if they were not the household head, we are left with 10% of children, which may have moved to a different household because of school quality. Nevertheless, this is a (relatively small) upper bound since parents may also send their children to their relatives because they have to work or they do not have the money to feed and raise them. It is thus plausible that economic reasons were pivotal among poorer households. Keeping this into account, only 3.6% of all the children in the relevant age group attending school were sent to relatives who belonged to the top two wealth quintiles.

A similar kind of student selection may occur if the whole household moved to a neighborhood with higher-quality school. Although this is usual in developed countries such as the United States, it seems unlikely in this context given the tight budget constraint. Indeed, as discussed in IMF (2014), migration in Togo is mainly driven by economic rather than educational opportunities. Thus, given the above discussion, we can conclude that sample selection due to student mobility was extremely limited and should not affect the validity of our results.

3.5 The Demand Side: Determinants of School Enrollment

This section focuses on the demand side: we look at the drivers behind a child enrollment status and examine it as a household decision. We do so by making use of QUIBB for the determinants of school enrollment and achievements. More in detail, as for the determinants of the school demand, we have mainly relied on the two waves of QUIBB, i.e. 2006 and 2011. This survey contains 7500 households who were interviewed in Togo during the first wave, including 36,430 individuals, whereas 5532 households and 29,781 individuals took part in the second wave. This repeated cross-section is extremely useful for the purpose of our research since it provides several information on household composition, education3, health, employment, assets, current expenditure, auto-consumption and income.

Table 3.4 shows the results about the determinants of school enrollment. The dependent variable is a dummy which is equal to 1 if the respondent was attending school at the time of the interview. Therefore, since this enrollment decision is represented by an indicator variable, it has been necessary to use a binary choice model, i.e. a Probit model. Only individuals aged between 6 and 15 years have been considered. The main dataset used in this analysis has been QUIBB 2006 and 2011, thus it has been possible to examine two time periods.

Column 1 in Table 3.4 contains a basic specification (17,968 observations), while Columns 2 and 3 show an extended model computed used Probit and Logit estimation methods respectively. Furthermore, in the last two columns the sample have been splitted: the same probit regression of Column 2 has been run for individuals aged 6–8 (Column 5) and 9–15 (Column 6). Marginal effects instead of coefficients are shown in all models displayed in Table 3.4.

First of all, it is interesting to note how household composition affects the variable of interest: if there are small children (aged 0–4), the respondents are less likely to go to school, especially for older individuals (age 9–15, Column 6). This is probably due to the fact that older children are expected to take care of their younger siblings while their parents work. In a specular way, a higher number of adults in the household increases the probability of going to school: this effect is statistically significant for individuals aged 9–15, but not for those aged 6–8.

Table 3.4 Enrollment probability (6–15). Probit and Logit

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Probit	*Probit*	*Logit*	*Parents*	*Age 6–8*	*Age 9–15*
Number babies (0–4)	−0.009536**	−0.015749***	−0.014215***	−0.010078**	−0.003768	−0.013079***
	(0.0029)	(0.0029)	(0.0027)	(0.0032)	(0.0053)	(0.0034)
Number children (5–15)	0.002937	−0.001219	−0.001553	−0.001513	0.004260	−0.005575**
	(0.0018)	(0.0018)	(0.0016)	(0.0020)	(0.0033)	(0.0020)
Number adults (>15)	0.010926***	0.006534***	0.006505***	0.007948***	0.006054	0.004103*
	(0.0019)	(0.0019)	(0.0018)	(0.0022)	(0.0038)	(0.0020)
Household head female (d)		0.087154***	0.077686***	0.051411	0.103630***	0.074406***
		(0.0089)	(0.0082)	(0.0295)	(0.0182)	(0.0095)
Max education household (head vs. spouse)	0.019071***	0.017899***	0.017219***		0.023082***	0.015509***
	(0.0008)	(0.0008)	(0.0008)		(0.0015)	(0.0009)
Education father				0.015220***		
				(0.0011)		
Education mother				0.016733***		
				(0.0017)		
Mother alive (d)	0.038971***	0.038243***	0.034367***	0.010327	0.019186	0.050210***
	(0.0106)	(0.0106)	(0.0100)	(0.0167)	(0.0209)	(0.0121)
Father alive (d)	−0.042709***	0.044743**	0.039024**	0.100819	−0.004914	0.069396***
	(0.0094)	(0.0150)	(0.0144)	(0.0832)	(0.0277)	(0.0173)

(continued)

Table 3.4 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Probit	*Probit*	*Logit*	*Parents*	*Age 6–8*	*Age 9–15*
Self-production (d)	−0.067156***	−0.034760***	−0.035749***	−0.046613***	−0.084934***	−0.010314
	(0.0092)	(0.0100)	(0.0097)	(0.0133)	(0.0187)	(0.0115)
Ln (total private expenditure pc)	0.010683*	0.003855	0.004912	−0.000568	0.016955	−0.006555
	(0.0052)	(0.0072)	(0.0068)	(0.0085)	(0.0134)	(0.0082)
Interaction female expenditure pc		−0.021715*	−0.021228*	−0.000416	−0.001820	−0.027496**
		(0.0090)	(0.0084)	(0.0110)	(0.0171)	(0.0103)
Female (d)	−0.077767***	0.121829	0.122475	−0.061594	−0.036690	0.166837
	(0.0059)	(0.0826)	(0.0785)	(0.1028)	(0.1577)	(0.0936)
Neither son nor daughter (d)	−0.040536**	−0.008533	−0.007583		0.001317	−0.001968
	(0.0135)	(0.0137)	(0.0129)		(0.0265)	(0.0150)
Distance from primary school (time)	−0.023282***	−0.022869***	−0.021251***	−0.021924***	−0.037859***	−0.012966***
	(0.0030)	(0.0030)	(0.0027)	(0.0033)	(0.0055)	(0.0035)
Distance from secondary school (time)	−0.018785***	−0.013494***	−0.012893***	−0.014691***	−0.014760**	−0.013181***
	(0.0027)	(0.0027)	(0.0025)	(0.0031)	(0.0050)	(0.0031)

(continued)

Table 3.4 (continued)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Probit	*Probit*	*Logit*	*Parents*	*Age 6–8*	*Age 9–15*
Distance from health center (time)	−0.012749***	−0.009116***	−0.008110***	−0.008281**	−0.008028	−0.009386**
	(0.0027)	(0.0027)	(0.0025)	(0.0031)	(0.0050)	(0.0030)
Distance from food market (time)	0.010540***	0.010266***	0.009417***	0.013211***	0.012075*	0.008858**
	(0.0027)	(0.0027)	(0.0025)	(0.0031)	(0.0048)	(0.0031)
Distance from public transport (time)	−0.003249	−0.013391***	−0.012321***	−0.013644***	−0.016654***	−0.011033***
	(0.0025)	(0.0025)	(0.0023)	(0.0028)	(0.0047)	(0.0029)
Household owns a mobile phone (d)		0.030277***	0.028124***	0.041016***	0.025310	0.035050***
		(0.0081)	(0.0077)	(0.0095)	(0.0156)	(0.0089)
Wave 2—2011 (d)		0.096733***	0.091663***	0.084659***	0.134950***	0.073701***
		(0.0070)	(0.0066)	(0.0080)	(0.0131)	(0.0080)
Maritime (d)	0.065625***	0.030963*	0.032443*	−0.016715	−0.110058**	0.064731***
	(0.0130)	(0.0141)	(0.0139)	(0.0248)	(0.0410)	(0.0127)
Plateaux (d)	0.016873	−0.024030	−0.023167	−0.077117**	−0.114090**	−0.004855
	(0.0153)	(0.0164)	(0.0168)	(0.0282)	(0.0418)	(0.0167)
Centrale (d)	0.073699***	0.041266**	0.040363**	−0.003310	−0.053425	0.060319***
	(0.0133)	(0.0143)	(0.0139)	(0.0250)	(0.0412)	(0.0133)

(continued)

Table 3.4 (continued)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Probit	*Probit*	*Logit*	*Parents*	*Age 6–8*	*Age 9–15*
Kara (d)	0.015299	−0.016422	−0.015410	−0.064770*	−0.118776**	0.007893
	(0.0156)	(0.0169)	(0.0171)	(0.0287)	(0.0446)	(0.0166)
Savanes (d)	−0.051193**	−0.080123***	−0.071915***	−0.098382***	−0.165483***	−0.064928**
	(0.0177)	(0.0188)	(0.0194)	(0.0289)	(0.0444)	(0.0201)
Observations	17,968	16,797	16,797	11,647	5893	10,904
Pseudo *R*-squared	0.125	0.145	0.146	0.177	0.175	0.146
Log_likelihood	−8087.87	−7136.91	−7129.15	−4870.15	−2721.85	−4252.39

Marginal effects. Robust standard errors in parentheses. Lomé is taken as reference region Individuals aged 6–15 are asked if they currently go to school. Education level is in years of school. Distances are reported as 15 min intervals. (d) for discrete change of dummy variable from 0 to 1. The following variables have not reported because not significant: dummy whether the household worked in the last 7 days, distance from water source (time), interaction female dummy with household auto-consumes, interaction female dummy with distance from water source (time), interaction female dummy with number of baby aged 0–2 in the household, ln(OECD equivalent private expenditure per capita), the household own a computer (d)

$^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$

The maximum education level of the household head (or of the spouse if higher) have a positive and significant effect in all specifications. In line with this finding, Column 4 shows the effects of mother's and father's education[4] on their offsprings'[5]: both variables have a positive and significant effect, and mother's education has a bigger impact than father's. Another relevant variable is the distance from primary school[6]: the effect is negative and strongly significant in all specifications.

If the household head is a woman, children are more likely to go to school (Column 2). The coefficient is statistically significant. Moreover, if parents are alive and live in the same household, the enrollment probability increases for individuals aged 6–15 and 9–15—and the effect is bigger for the mother rather than the father—whereas it is not significant for respondent aged 6–8. In addition to this, children who live in households producing part of the goods consumed by the members themselves are less likely to attend school, especially if aged between 6 and 8, probably because they are involved in the production process.

Quite surprisingly, neither the natural logarithm of total consumption per capita nor the gender indicator has some significant effect. On the other hand, the interaction between these two variables is negative and significant (albeit it is no longer significant when only people aged 6–8 are considered). The actual and potential impact of ICT on the education process is stressed by the positive and significant effect of mobile phones: the dummy signaling whether the household owns a mobile phone has a positive and significant coefficient both for children aged 6–15 and 9–15.

In line with the descriptive statistics, the improvements observed between 2006 and 2011 are reflected in the positive and significant coefficient of the time dummy. Finally, from a geographical point of view, Savanna seems the region where children are less likely to go to school, whereas Coastal Region have a positive and significant coefficient in

[4] Therefore, the variable "Max education in the household (head vs. spouse)" have been dropped.

[5] Since only natural sons and daughters have been included in this regression, the variable "No son nor daughter" have been omitted.

[6] Distances are reported as 15 min intervals. In other words, the variable distance from primary school takes value 1 if the respondent spent up to 14 minutes to go to school, 2 if the time was between 15 and 29 minutes, 3 between 30 and 44, 4 between 45 and 60, 5 if the student had to travel more than an hour to reach her primary school.

Column 2 (age 6–15), as well as in Column 6 (age 9–15), whereas the estimated relation is negative and significant in Column 5 (age 6–8). Central Region has a positive and significant coefficient both in Columns 2 and 6 (Lomé has been taken as a reference point in order to avoid perfect multicollinearity).

In the first two columns of Table 3.5, the same model as in Table 3.4 (Column 2) has been estimated while distinguishing between waves. The remarkable improvements achieved during that period are highlighted by the weaker coefficients of the regional dummies in 2011 than 2006. Indeed, only the marginal effect of Coastal remained still significant in wave 2, thus regional differences had almost disappeared between 2006 and 2011. Moreover, the self-production dummy—which is equal to 1 if the household produced (part of) the goods which consumed—was no longer significant in 2011: this may be interpreted as a good signal since more children enrolled in school in 2011 instead of working within the household.

The last column of Table 3.5 includes the natural logarithm of public expenditure on primary school per student and the total number of students in primary schools in 2011. In this specification it was not possible to include all regional dummies, otherwise there would have been perfect collinearity. Therefore, only two dummies for Gulf Lomé and Savanna have been added. Contrary to what was expected, the coefficient of public expenditure is significant and negative.

In order to deepen our analysis, we have considered not only whether individuals were attending school at the time of the interview, but also the highest educational level achieved by individuals between age 6 and 15. To do so, Table 3.6 takes as dependent variable the respondent's years of education. In order to avoid a selection bias, we have used the Heckman estimation method: the selection variable is a dummy which indicates whether the individual had ever been to school. As reported at the end of the table, the arthrho is statistically different from 0, therefore taking into account such selection bias seems the appropriate procedure.

Similarly to the findings of the probit analysis, if there are babies in the households aged 0–4 years, there is a negative and significant effect on educational achievements, while the number of adults, as well as the number of children (which was not significant previously), have positive and significant coefficients. Affiliation matters: not being the household head's child does not affect the probability of attending school, as shown

Table 3.5 Enrollment probability (6–15)

	(1)	*(2)*	*(3)*
	Wave 1 2006	*Wave 2 2011*	*Wave 2 2011*
Ln (public expenditure per student)			−0.021263*
			(0.0104)
Number babies (0–4)	−0.017364***	−0.013502***	−0.013567***
	(0.0052)	(0.0032)	(0.0032)
Number children (5–15)	0.004497	−0.003336	−0.003596
	(0.0032)	(0.0019)	(0.0019)
Number adults (>15)	0.006718*	0.007983***	0.008550***
	(0.0033)	(0.0022)	(0.0021)
Household head female (d)	0.089179***	0.079338***	0.079188***
	(0.0150)	(0.0101)	(0.0101)
Max Education household (head vs. spouse)	0.020015***	0.014812***	0.014700***
	(0.0012)	(0.0010)	(0.0010)
Mother alive (d)	0.060079***	0.022886	0.022338
	(0.0170)	(0.0127)	(0.0126)
Father alive (d)	0.042476	0.046604*	0.046728*
	(0.0236)	(0.0181)	(0.0182)
Self-production (d)	−0.069504***	−0.007687	−0.008930
	(0.0154)	(0.0129)	(0.0128)
Ln (Total private expenditure per capita)	0.019910	0.001414	0.003484
	(0.0123)	(0.0086)	(0.0087)
Interaction female expenditure pc	−0.023518	−0.017503	−0.018331
	(0.0147)	(0.0106)	(0.0107)
Female (d)	0.126068	0.095617	0.103128
	(0.1336)	(0.0988)	(0.0995)
Neither son nor daughter (d)	−0.009036	−0.004765	−0.004654
	(0.0224)	(0.0160)	(0.0160)
Distance from primary school (time)	−0.021042***	−0.021572***	−0.021070***
	(0.0050)	(0.0035)	(0.0035)
Distance from secondary school (time)	−0.011658**	−0.013822***	−0.014354***
	(0.0042)	(0.0034)	(0.0034)
Distance from health center (time)	−0.010664*	−0.007527*	−0.007297*
	(0.0043)	(0.0032)	(0.0032)
Distance from food market (time)	0.009067*	0.007603*	0.005984
	(0.0039)	(0.0036)	(0.0036)
Distance from public transport (time)	−0.018609***	−0.006433	−0.005588
	(0.0038)	(0.0034)	(0.0034)
Household owns a mobile phone (d)	0.046768**	0.026563**	0.028335**
	(0.0159)	(0.0089)	(0.0089)
Savanes (d)	−0.101121***	−0.018133	−0.055660***

(continued)

Table 3.5 (continued)

	(1)	(2)	(3)
	Wave 1 *2006*	*Wave 2* *2011*	*Wave 2* *2011*
	(0.0273)	(0.0239)	(0.0120)
Lomé (d)			−0.017324
			(0.0251)
Maritime (d)	0.063014**	0.045119*	
	(0.0204)	(0.0177)	
Plateaux (d)	−0.008878	0.006479	
	(0.0233)	(0.0218)	
Centrale (d)	0.077594***	0.037633	
	(0.0201)	(0.0193)	
Kara (d)	−0.012059	0.019745	
	(0.0246)	(0.0208)	
Observations	8782	8015	8015
Pseudo R-squared	0.147	0.126	0.125
Log likelihood	−4110.46	−2999.21	−3003.69

Marginal effects. Robust standard errors in parentheses. Data on public expenditure available only in 2011. (d) for discrete change of dummy variable from 0 to 1. Public expenditure includes expenditure on staff for preschool and primary education. Individuals aged 6–15 are asked if they currently go to school. Education level is in years of school. Distances are reported as 15 min intervals

$^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$

in the enrollment rates estimations, but it does negatively influence the investment in more advanced education.

Again, if the head of the household is female, or she has a high level of education, children are more likely to achieve higher educational levels. Furthermore, if there is some form of self-production, or if the primary school is distant, the expected education acquired by children is lower. On the other hand, the improvements occurred over the last years are verified by the positive coefficient of the time dummy, while it should be stressed that regional differences are even higher in this model since all geographical dummies except Central have a negative and significant coefficient. Finally, in this case not only private expenditure per capita and the gender dummy are statistically insignificant, but even the interaction between these two variables is no longer significant.

Table 3.6 School achievements (6–15). Heckman

	(1)	*(2)*
	Year education	*Ever gone to school*
Number babies (0–4)	−0.319757***	−0.114584***
	(0.0207)	(0.0095)
Number children (5–15)	0.045969***	0.011212*
	(0.0125)	(0.0056)
Number adults (>15)	0.155505***	0.058240***
	(0.0123)	(0.0059)
Household head female (d)	0.508948***	0.197370***
	(0.0790)	(0.0380)
Max education household (head vs. spouse)	0.120820***	0.058441***
	(0.0052)	(0.0027)
Mother alive (d)	−0.184388**	−0.045599
	(0.0681)	(0.0326)
Father alive (d)	−0.391237***	−0.158442***
	(0.0917)	(0.0443)
Self-production (d)	−0.352352***	−0.188359***
	(0.0644)	(0.0351)
Ln (total private expenditure per capita)	0.042751	0.047041*
	(0.0473)	(0.0226)
Interaction female expenditure pc	0.049929	0.013097
	(0.0609)	(0.0290)
Female (d)	−1.002680	−0.367056
	(0.5717)	(0.2700)
Neither son nor daughter (d)	−0.843895***	−0.323552***
	(0.0910)	(0.0433)
Distance from primary school (time)	−0.096577***	−0.053916***
	(0.0235)	(0.0103)
Distance from secondary school (time)	−0.155219***	−0.059414***
	(0.0191)	(0.0089)
Distance from health center (time)	−0.033446	−0.025955**
	(0.0188)	(0.0088)
Distance from food market (time)	0.070442***	0.033122***
	(0.0184)	(0.0086)
Distance from public transport (time)	−0.093921***	−0.044452***
	(0.0183)	(0.0083)
Household owns a mobile phone (d)	0.264920***	0.112153***
	(0.0550)	(0.0272)
Wave 2—2011 (d)	0.475004***	0.223110***
	(0.0495)	(0.0233)
Maritime (d)	−0.245455**	−0.123515*
	(0.0856)	(0.0509)
Plateaux (d)	−0.266192**	−0.161414**

(continued)

Table 3.6 (continued)

	(1)	*(2)*
	Year education	*Ever gone to school*
	(0.0926)	(0.0530)
Centrale (d)	0.004187	−0.009589
	(0.0947)	(0.0545)
Kara (d)	-0.326618^{***}	-0.189849^{***}
	(0.0966)	(0.0545)
Savanes (d)	-0.696105^{***}	-0.332999^{***}
	(0.0978)	(0.0545)
Constant	3.527651^{***}	1.049962^{***}
	(0.4816)	(0.2307)
Athrho	2.845714^{***}	
	(0.0366)	
Ln(sigma)	0.920123^{***}	
	(0.0062)	
Observations	16,804	
Log likelihood	−3.6e+04	

Standard errors in parentheses. Lomé is taken as reference region. Individuals aged 6–15 are asked if they have ever been to school and their highest educational level. Education level is in years of school. Distances are reported as 15 min intervals
$^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$

3.6 Conclusions

By 2010/2011 the public education system had made substantial improvements in enrollment. In fact, the percentage of children who had never gone to school has decreased sharply between 2006 and 2011 in all regions and across all wealth quintiles. Nevertheless, there remain significant challenges in how to bring the remaining children into school, how to accommodate the large influx of new students, how to improve levels of learning and how to reduce regional inequalities.

The assessment of the decision drivers to send one's children to school demonstrates that this decision is explained by a combination of household-specific variables and variables that can be affected through public policy. We find no evidence for the level of household expenditure mattering for school attendance and grade achievement, which is encouraging. Certain determinants fall largely outside the scope of public policy-making: household composition, or having a female household head. Other determinants can only be slowly affected by public policy, such as the level of education of one's parents. Yet other variables suggest that public resource availability matters. Distance to school, for instance, is a significant driver of the decision to attend school.

By carrying out a stochastic frontier analysis, this chapter also looked into the school-level drivers of performance (defined by passing the CEPD exam) for those students who attend school. A key result is that differences in performance between schools are mainly attributable to a lack of resources and less to differences in technical efficiency. This is an important point, because this chapter has also noted that resources are distributed unevenly among regions and schools. By improving access to inputs, particularly in the underserved schools, performance can be expected to go up considerably.

The fact that inefficiency is a less important factor explaining differences in performance should not be taken to mean that there are no efficiency issues affecting primary schools in Togo. As the SDI survey (discussed in Chapter 4) will demonstrate, teachers only spend around 50% of their time teaching. This is an important inefficiency, which needs to be addressed. What the regression analysis suggests is that these inefficiencies affect all schools more or less equally, but also that they might be picked by our control variables. For instance, and we are speculating here, the reason why the presence of more permanent teachers has a negative impact on performance might be because once made permanent, teachers are less motivated to show up and teach. The latter, how to motive teachers, is something to consider carefully, particularly if the Government of Togo is considering the possibility to hire additional permanent teachers.

The results also suggest the importance of paying more attention to the learning environment. The effects can be subtle and are, at times, surprising. Combining the first two classes of primary school has been found to have a positive relation with performance, but combining the last two classes not. Improving teacher quality may also have an important impact on performance, but teacher quality (as expressed through experience or qualifications) is different from hiring permanent teachers. Finally, schools with higher repeating student rates perform worse, and schools that manage to retain more girls perform better.

Appendix

See Table 3.7.

Table 3.7 Summary statistics

Variables	*Mean*	*St. Dev*
Number of teachers	5.36	1.86
Teacher students	2.69	1.05
Average qualification teachers*private	0.60	1.07
Private	0.26	0.44
Repeating students rate	0.22	0.12
Ln Average teacher age	3.64	0.13
Female headmaster	0.07	0.26
Female ratio in CM2	0.41	0.15
Average qualification teachers	2.42	0.62
Average student age in CM2	11.91	1.05
Seat every 100 students	82.18	38.65
Desk every 100 students	41.12	19.82
Toilet every 100 students	1.11	1.47
Water	0.35	0.48
Math-book per student	0.34	0.33
Read-book per student	0.49	0.42
CP1-2 taught together	0.22	0.41
CE1-2 taught together	0.35	0.48
CM1-2 taught together	0.45	0.50
Employment rate	70.53	8.72
Employment rate (w/o salary)	87.97	8.75
Dependency ratio	54.53	5.90
Enrollment primary	78.78	7.80
Enrollment secondary	37.04	14.60
Urban	0.26	0.44
Admitted CEPD/Tot students in the school	0.08	0.04
Observations	3957	

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