THE EFFECTS OF SCHOOL QUALITY ON DROPOUT RATES IN MALI AND STUDENT ACHIEVEMENT IN SENEGAL

by

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STATEMENT OF THESIS APPROVAL

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ABSTRACT

International community's commitment to achieve universal primary education triggered an increase in primary school enrollment in the developing world. Unfortunately, this increase in quantity (the number of students) led to the emergence of very big class sizes, multigrade, and double-shift schooling. Accordingly, this study fills a hole in the literature by investigating the impact of multigrade classrooms and double-shifts on the dropout rate in Mali. Simultaneously, it also examines the impact of not completing the curriculum required on student test scores. Some surprising and interesting results show that schools that have libraries are less expected to have dropouts compared to schools that do not. I also found strong evidence that schools that do not collect fees on a consistent basis are likely to have higher dropout rates compared to schools that do.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

A growing number of researchers believe that developing countries should bank on their human capital in order to fuel economic growth and overcome their economic challenges. Some benefits of having an educated labor force, among many others, include better health, productivity and income (ShahzadAlvi, 2013), and economic growth (Baro, 2013). Therefore, education systems in these countries have undergone major reforms, especially since the 1990 international community commitment to achieve Universal Primary Education (UPE) by 2015. An outcome of this commitment, which was renewed at the 2000 World Education Forum in Dakar, Senegal, was an increase in foreign aid flowing to developing countries, not to mention the pressure of donors and economic partners to increase school enrollments.

Consequently, developing countries have significantly increased their funding of education and enrollment of students in basic education. Thus, real government spending on education skyrocketed almost eight times in South Asia, almost tripled in the Middle East, and doubled in Latin America and Sub-Saharan Africa since 1980 (Glewwe, Hanushek, & Humpage, 2012). In addition, world primary school enrollment swelledfrom 86.7 million in 2000 to 128.6 million in 2008 with the Gross Enrollment

Ratio[1] exceeding 100%. In Sub-Saharan Africa alone, primary school enrollment increased 48% during the same period of time (UNESCO, 2011).

Unfortunately, developing countries' meager resources could not keep up with this great increase in the number of students, which has led to very large class sizes and the use of coping methods such as "double shifts." Double-shift schools, also referred to as half-day schools, serve a greater number of students by having a group of students use school facilities early in the day and another group later in the day. The "thumb up" of this method is that schools can serve more students without ever having to build more buildings. The "thumb down" of it is that students may study fewer hours than they should. In rural areas in Vietnam, more than 90% of children attend schools with two or more shifts, plummeting the average class time to only 3 hours and 10 minutes per day (Glewwe, 2004). This has obvious detrimental effects on student learning.

Another practice that could potentially undermine the quality of education is multigrade schooling. Multigrade schooling involves teaching groups of students from different grades in the same classroom. It may result from schools that would have double shifts if there were enough demand, but are either so unpopular or remotely located that they do not have enough students per grade. While the effect of this method on student learning is unclear, just like double-shifts teaching, it casts doubts on the quality of education. Accordingly, this study aims to understand the effect of the quality of schools on student achievement and dropout rates in two countries that are not doing very well in comparison to other developing countries: Mali (COFEMEN, 2004) and Senegal (Michaelowa, 2001). Specifically, this paper examines the impact of double-shift

[1] Described as the total enrollment within a country in a specific level of education, regardless of age, expressed as a percentage of the population in the official age group corresponding to this level of education

and multigrade schooling on dropout rates in Mali. While double-shifts and multigrade schools are used as the measure of the quality of schools in Mali, I could not find similar data for Senegal. Therefore, I measure the quality of schools in Senegal by means of a continuous variable that accounts for schools that fail to meet learning objectives set in the official curriculum. In respect to Senegal, this article investigates how schools that do not teach the totality of the required program affect student test scores. These twin goals allow this study to contribute to the ever-growing and interesting research about education in developing countries.

In recent years, many studies have shed more light on the type of inputs that impact student learning. For instance, some studies highlight the need for more teachers and increase of their incentives (Mingat & Suhaut, 2000; Mingat et al., 2003; Naervcio, 2007; Nkengne, 2010). Moreover, the effect of class size reduction was found to be positively related to student achievement in Bolivia (Miguel, 2006) whereas Asadullah found that class size reduction was not an efficient policy in Bangladesh (2005). Other studies found that textbooks increased the scores of the best students, but had little effects on other students in Kenya (Glewwe, 2009) while a strong positive correlation between test scores and textbook possession was found in 22 African countries (Glewwe & Kermer, 2006). In fact, Frolich found that textbooks have also positive and very large externalities on other students in the classrooms of five Sub-Saharan countries (2011). The studies discussed above indicate positive significance of textbooks on test scores and mixed evidence about class sizes.

Glewwe and Kermer (2006) draw a comprehensive picture of the actual state of education in developing countries by examining the impact of different inputs and

policies on education in less developed countries. His evaluation of retrospective studies indicates mixed evidence on the extent to which school participation responds to school quality. However, Handa and Simler (2006) show that building more schools in targeted areas of Mozambique has a positive effect on students' grades. Their model has the particularity of considering not only the quality (measured by the student-teacher ratio), but also the quantity (building more schools) of school investments.

Surprisingly, fewer studies were conducted with regards to multigrade teaching and classrooms in shifts. A synthesis of findings of researches about the cognitive and noncognitive effects of multigrade teaching in elementary school revealed no empirical evidence for the assumption that student learning may suffer. This conclusion was reached after the review of studies done in 56 countries, but neither Mali nor Senegal was included (Veenman, 1995). However, offering half-day education in shifts is consistently associated to lower achievement (Lee et al., 2005) with the exception of few studies that posit that it does not necessarily cause a decline in quality (Bray, 2000; Herrera, 2003). Moreover, Diagne (USAID, 2006) found a negative correlation between low success in moving to the next grade within a community and dropping out of school in Senegal. The above literature review offers to the reader a glimpse to the wealth of knowledge already available.

Despite the abundance of studies about education in developing countries and the body of knowledge derived from it, there is still room for more exploration. For example, to my knowledge, no study has been done on the effects of double-shift and multigrade schooling on the dropout rate in Mali. One of the goals of this paper is to fill this void. Admittedly, quite a few studies looked at the impact of various inputs on test scores in

Senegal, but this paper focuses on the impact of not completing the school curriculum. Investigating this double query, one on Malian and the other on Senegalese schools, will provide evidence for policy recommendation regarding coping methods, such as shifts, which might undermine the quality of education. The following section gives more information about these methods and discusses background information about the two countries. Chapter 3 describes the data and model while Chapter 4 presents the results; finally, Chapter 5 provides some policy recommendations and concluding remarks.

CHAPTER 2

INSTITUTIONAL BACKGROUND

School systems in Mali and Senegal are identical in structure to the French school system, where basic education includes a primary school that goes from the first grade to the fifth grade and 3 more years of education in Mali, but 4 in Senegal. This study focuses only on fifth grade students because the dropout rate tends to be higher after this elementary class and the number of students who make it up to fifth grade is lower. For example, more than two students out of three do not make it to the fifth grade in Senegal (CONFEMEN, 2007). An explanation for this high dropout rate comes from Diagne, who found evidence for high dropout rates among student groups involved in child labor (USAID, 2006). In addition, fifth grade is also a good measure of the foundation students acquire for the rest of their academic career because they would already have the necessary literacy and numeracy tools.

The resemblance with the French educational system is not fortuitous because Senegal and Mali are both former French colonies that obtained their independence in 1960. Despite remarkable economic improvement in recent years, Senegal and Mali are still among the poorest countries in the world. According to the most recent data

available on the World Bank database,[2] 50.6% of Malians lived with less than $1.25 per day in 2010 and 34.1% of people from Senegal had to make do with the same amount of money in 2011. In 2010, annual GDP growth[3] was 5.8% (2.1% in 2013) in Mali and 4.3% (4.0% in 2013) in Senegal. In order to cope with poverty, some parents use their children's labor as an extra source of income. In rural areas, it is common that boys help their parents with farm work and do a bit of business on the side while girls help out with household chores. Therefore, families do not have much incentive to have their children spend too much time in school. The older a child is, the more productive she will be, and the less likely she is to stay in school due to the lost opportunities that parents perceive.

Therefore, there are high enrollments in primary schools whereas the number of enrolled students keeps on dropping as the education level goes up. In 2012, primary school gross[4] enrollment rates (percentage of children aged 7-12) were 88% in Mali and 84% in Senegal compared to only 44% and 41% secondary gross enrolment rates (percentage of children aged 13-15) in both countries, respectively, in 2011. These figures were only 29% primary school enrollment rate in Mali and 54% in Senegal in 1990. This leap in the number of students (203% increase in Mali) led to huge class sizes and the emergence of coping techniques such as a) teaching in shifts, b) contractual teachers who are less trained compared to their conventional counterparts, c) and multigrade classrooms. The above discussion shows that primary and secondary education play important roles in the educational system in these countries, which is a

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[2] Word Bank Development Indicator Tables.
http://data.worldbank.org/indicator/SI.POV.DDAY/countries/SN-ML?display=graph
[3] World Bank Development Indicator Tables.
http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG
[4] World Bank Development Indicators Tables.
http://data.worldbank.org/indicator/SE.PRM.ENRR/countries?page=4

significant detail that should be taken into consideration when building the models to describe education in these countries.

CHAPTER 3

DATA AND ECONOMETRIC METHODS

Data

The data come from a survey conducted by the Program on the Analysis of Education Systems (PASEC), of the Conference of the Ministers of Education of French speaking countries (COFEMEN). Carried out in 2006, the survey includes more than 2000 fifth-grade students from Senegal (data available on COFEMEN's website). PASEC administrates standardized tests in Mathematics and French for many francophone countries, including Senegal and Mali. There is a test at the beginning of each academic year that I will be referring to at times as "pretest" or "initial" score and another test at the end of the year. PASEC also gathers detailed information about teachers and students, including age, gender, and participation in child labor. In addition to this wealth of information, PASEC rigorously keeps the data useful by paying attention to such details as differences in countries, and following up on schools and students who were randomly surveyed. Even the random selection of schools to be surveyed is carefully thought out beforehand.

The PASEC data for Mali are different from that of Senegal due to the fact that they were collected specifically for measuring contract teachers and double shift teaching. For this reason, I use different dependent and independent variables to answer the

research question. The data for Senegal have variables that deal with students and their test scores whereas the data for Mali provide information about different sets of variables related to school characteristics, including shifts and multigrade classrooms, exam results, and library availability. Observations are by grades. The fact that the Malian data, which are from the 2002-2003 academic year, is thematic (dealing with a particular research question) could be problematic. It may not be representative of the population and opens room for some selection bias, for which I have no way to adjust.

It is worth mentioning a few more shortcomings of both data. First, there are significant numbers of missing observations for some variables, especially at the student level. Self-report information from children could be difficult to keep clean and trustworthy. Second, there is no codebook available, which means that the study could be biased if the researcher wrongly misinterprets information from the labels. Nevertheless, these shortcomings should not undermine the blessing of having this type of rare data available.

Model for Mali

To assess the impact of shifts and multigrade schooling on students dropping out of schools, I use the following equation:

$$\begin{matrix} & & & + & & + & & - & & ? & \\ (1)\ dropout = & \beta_0 + & \beta_1 shift + & & \beta_2 multigrade + & & \beta_3 exam + & & \beta_5 electric + & & \\ - & & ? & & ? & & ? & & - & & \\ + \beta_8 lib + & & \beta_{10} fee + & & \beta_{11} feecoo + & & \beta_{12} default + & & \beta_{13} tsalary + & & \varepsilon \end{matrix}$$

Where β_0 is the constant and β_1 - β_{13} are slope coefficients of the independent variables. ε is the error term, which is assumed to be normally distributed. Table 1 contains

descriptions of all variables. For convenience, all categorical variables, noticeable by question marks on top of them in equation (1), are redefined as dichotomous variables in Table 1. The signs and question marks on top of variables indicate the intuitive expected signs for each variable. For instance, the positive sign on top of variable *shift* denotes that schools in shifts should be expected to have more student dropouts compared to schools that do not offer classrooms in shifts. Equation (1), which assumes linearity, is estimated using the Ordinary Least Squares (OLS) estimation method.

The dependent variable is the total number of students who graduated in the academic year 2002-2003 and did not come back in year 2004-2005. This variable is used to represent the number of students who dropped out of school even though there is a chance that students who do not come back to school may do so because they transferred to other schools. This study is interested in figuring factors that might influence those potential decisions. Table 2 provides descriptive statistics for the distribution of this variable, *dropout*.

The two focal independent variables are yes-or-no dummy variables, asking the questions of whether a) there are classrooms on double shifts (*shift*) and b) there are multigrade classrooms (*multigrade)*. One problem with estimating this model is that there is a risk of bias if, for example, a student moves from a school that offers multigrade classrooms (or shifts) to another that does not. To take this into account and for robustness check, the famous value-added feature is built into this model by controlling for the number of students who succeeded in the exam for the last grade in primary school (6^{th} grade). Also, this variable is used to avoid omitted variable bias by accounting for a student's ability. For instance, if students drop out of schools just because they

could not do it, then the variable will account for this possibility. It represents the knowledge and skills the student acquired over time. This is a feature that will also be valuable for the Senegalese model.

Model for Senegal

In order to measure whether student test scores are affected when they learn less than the learning objectives set in the official curriculum, I use two sets of equations with two distinct dependent variables: student final scores for French (*finscor*) and student final scores for Math (*finscorm*). Table 2, Figure 1, and Figure 2 provide descriptive statistics and histograms for *finscor* and *finscorm*, respectively. The relationship between dependent and independent variables is captured by the following mathematical equation:

$$\underset{(2)}{} \; finscor = f(\underset{+}{iniscor}, \underset{?}{male}, \underset{+}{tsalary}, \underset{+}{tvillage}, \underset{-}{stuperbook}, \underset{+}{guideuse}, \underset{+}{percentprog}, \underset{-}{stufarm})$$

Equation (2) claims that students' final scores in French (equation for Math is omitted because of reciprocity) are a function of their initial scores, gender (*male*), whether they work on a farm, student/book ratio, percentage of the school curriculum completed, teachers' salaries, whether their teachers use the teacher guidebook or not, and whether or not the teachers live in their village.

In addition to stating that students' final scores are a function of the aforementioned inputs, equation (2) is also stating that one can expect a positive impact on students' scores from all mentioned regressors except the student-book ratio and *stufarm*, both of which should negatively impact test scores. It is harder to hypothesize whether gender matters in getting a good test score. On the one hand, if boys are expected

to work too much, this may affect their grades. The same holds true for girls on the other hand, *ceteris paribus*. Furthermore, it makes intuitive sense that having many students share one book may not help students get an understanding of the reading. Assuming linearity, this implies that the population regression function can be written as follows:

$$(3)\ finscor = \beta_0 + \beta_1\, iniscor + \beta_2\, male + \beta_3\, tsalary + \beta_4\, tvillage + \beta_5\, stuperbook + \beta_6\, guideuse + \beta_7\, percentprog + \beta_8\, stufarm + \varepsilon$$

Table 3 includes a description of variables for the Senegalese dataset. Equation (3) is estimated using the Ordinary Least Squares (OLS) estimation technique. The remainder of this section discusses a few identification issues related to this model and brings forth more information about some variables of importance.

First, the main independent variable of interest is the percentage of the school curriculum that actually gets taught (*percentprog*). If Bonnet (2008) is right by asserting that: "it has been shown (Mingat, 2003) that African children master, on average, only 51.6% of the official school curriculum. Not having been taught that curriculum is the first obstacle on the road to mastery" (p. 337), then the model should not fail to capture this fact. This is the main reason why this variable is of primary interest. It is also a reflection of the quality of the school. Schools that fail to finish the material they are supposed to teach to students may not be qualified as serious or of high quality. Gender (*male*) is another important variable since the above discussion stretched the fact that boys and girls are expected to help the household in different ways. Thus, it might be interesting to estimate whether being a boy or a girl who wears at the same time a "student-hat" and "farmer-hat" hinders the expected final score. This is the reason why (*stufarm*), a variable that represents students who help out on farms, is part of the

population equation.

Second, it makes intuitive sense that a student's final score will most likely be influenced by his or her initial score. In fact, it might be interesting to see to what extent an initial good score can predict a final score. Controlling for this variable is of utmost importance because it helps account for, or at least reduce, endogeneity issues inherent to the kind of model used in this study. It is a very good remedy for avoiding omitted variable bias when student abilities are not accounted for. The practice of controlling the pretest, called value added (Hanushek, 1986), is also widely used in the literature. As Fehrler mentioned (2009), including pretests in the regression equation implies that the coefficients of all other variables reflect the influence on pupils' progress over time, rather than on students' final skills. Therefore, this feature has the power of changing the interpretation of all the other coefficients.

Third, characteristics related to teachers are always important to consider since teachers are the prime factor that influence student learning. Teacher salaries (*tsalary*) is a variable that is of special interest because it is a well-known fact that incentive matters in any business. Besides teachers' salaries, their proximity to school may be important. If a teacher is sometimes late, it may affect students' grades. Alternatively, if teachers are part of the same community where they teach, they might have a different effect on students compared to teachers remotely located from the community. Variable (*tvillage*), which indicates whether the teacher lives in the same village/town as the school is located, captures this factor. Another characteristic of a teacher that may have an impact on students' scores is whether or not the teacher uses the teacher guidebook to help teach French/Math (*guideuse/guideusem*).

Last, the proportion of student per book (*stuperbook*), as we learn from the literature, is an important factor that might impact a student test score. A special note may be helpful in order to understand why this variable is controlled. In Senegal, most students do not have the textbook at home. Therefore, the schools that are fortunate enough to own textbooks will provide them in class and take them back at the end of the class period. When the number of students exceeds the number of books, then students share the books. This difference between schools that have books and those that do not could potentially bias the results if students change schools over time. Accounting for the pretest could resolve such issues but to be on the safe side and get unbiased results, school effects are controlled for.

TABLE 1: VARIABLE DESCRIPTION FOR MALI

dropout:	total number of student who finished academic year 2002-2003 and did not come back the following academic year
shift:	= 1 if there are classes in shifts at the school, 0 otherwise
multigrade:	= 1 if there are classes in double-grade at the school, 0 otherwise
exam:	total number of students who passed the exam for 6^{th} grade
private:	= 1 if electricity is supply by the private sector, 0 otherwise
prigen:	= 1 if electricity is privately generated, 0 otherwise
public:	= 1 if electricity is publicly generated, 0 otherwise
sol:	=1 if electricity is generated using solar panels, 0 otherwise
noelec:	= 1 if there is no electricity at the school, 0 otherwise
otherelec:	=1 if other source of electricity is used at school, 0 otherwise
jnal:	= 1 if there is a school journal, 0 otherwise
wc:	= 1 if there are working bathrooms at school, 0 otherwise
lib:	= 1 if there is a library at school, 0 otherwise
clinic:	= 1 if there is a school clinic, 0 otherwise
maybefee:	=1 if paying school fee is unpredictable, 0 otherwise
nofee:	=1 if there is no school fee, 0 otherwise
yesfee:	=1 if pay school fees is obligatory, 0 otherwise
maybecoop:	=1 if paying fees for cooperatives is random, 0 otherwise
nocoop:	= 1 if no cooperative's fee exist, 0 otherwise
yescoop:	=1 if paying fees for cooperative is obligatory, 0 otherwise
waivedefault:	=1 if school fee is waived in case of default, 0 otherwise
outdefault:	=1 if student is kicked out of school due to not payment, 0 otherwise
otherdefault:	=1 if other actions are taken when students default, 0 otherwise
staydefault:	=1 if student is prevented from moving to higher grade level due to nonpayment, 0 otherwise
tsalary:	teacher monthly salary, in CFA
area2:	=1 if school is located in rural area, 0 otherwise

TABLE 2: DESCRIPTIVE STATISTICS FOR DEPENDENT VARIABLES

Variable	Observation	Mean	Standard Deviation	Min	Max
finscor	1910	38.28	18.02	0	97.37
finscorm	1910	43.24	17.36	0	97.30
percentprog	2003	70.63	19.87	13	100
Droprate (number of dropouts/number of classrooms)	3309	11.80	22.45	0	258.33

TABLE 3: VARIABLE DESCRIPTION FOR SENEGAL

finscor:	final score in literacy, percent of correct answer (0-100%)
male:	= 1 if male student, 0 otherwise
tinvillage:	= 1 if a teacher lives in the same village/town as the school, 0 otherwise
percentprogd:	percentage of official academic curriculum done
iniscor:	pre-score in literacy, percent of correct answer (0-100%)
stuperbook1:	= 1 if 1 book for 1 student, 0 otherwise
stuperbook2:	= 1 if 1 book for 2 students, 0 otherwise
stuperbook3:	= 1 if 1 book for 3 students, 0 otherwise
stuperbook4:	= 1 if 1 book for 5 students, 0 otherwise
stuperbook5:	= 1 if 1 book for more than 5 students , 0 otherwise
stuperbook6:	= 1 if no book
*guideuse*1	= 1 if a teacher does not have the French teacher guidebook, 0 otherwise
*guideuse*2	= 1 if a teacher never uses the French teacher guidebook , 0 otherwise
*guideuse*3	= 1 if a teacher rarely uses the French teacher guidebook, 0 otherwise
*guideuse*4	= 1 if a teacher uses the French teacher guidebook sometimes, 0 otherwise
*guideuse*5	= 1 if a teacher always uses the French teacher guidebook, 0 otherwise
stufarm:	= 1 if student works in a farm, 0 otherwise

Note: Variables for the math subject has similar description

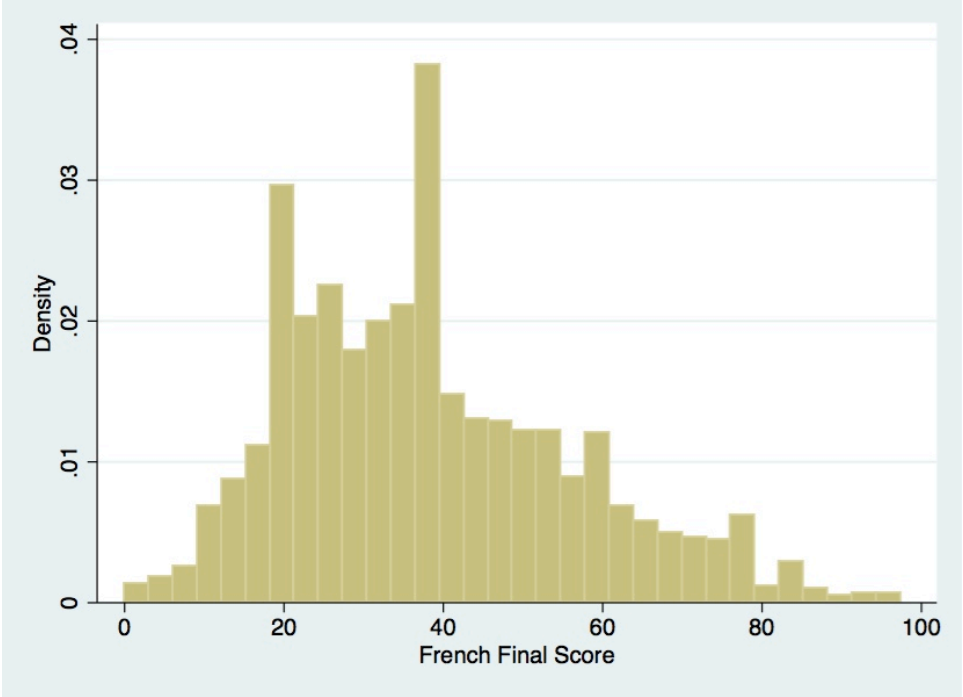

FIGURE 1: FINAL FRENCH SCORE DISTRIBUTION

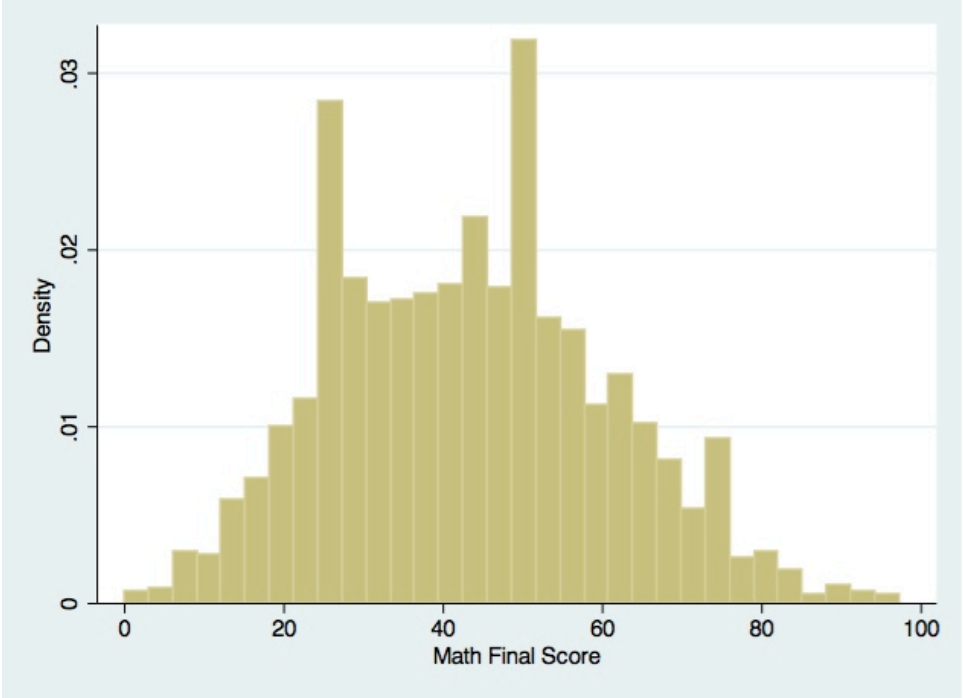

FIGURE 2: FINAL MATH SCORE DESCRIPTION

CHAPTER 4

MODEL ESTIMATION AND ANALYSIS

Estimation of the model produces many results, some of which are consistent with studies done on other countries. Table 4 presents the estimation of equation (1), without taking into account grade fixed effects (urban or rural in Mali) in column 1 and with grade fixed effects in column 2. In general, controlling for grade fixed effects does not change the model very much. It had an impact on either the magnitude or the significance of some variables.

The main two independent variables of interest are not both statistically significant at conventional significance levels. On the one hand, with a 5% significance level, column 2 of Table 4 shows that schools that have classes in shifts are estimated to have about 2 more student dropouts, compared to their counterparts that do not indulge in the practice of "shifts." Thus, I join Fehrler (2009) in saying that double shift teaching should generally be avoided. In addition, Lee et al. (2005) would agree with this statement since they found that student achievement was typically lower in schools that practice "shifts." On the other hand, the variable that captures schools with multigrade classrooms came out to be insignificant. One would think that students would not want to stay in schools that offer classes not quite adapted to their levels. However, giving it a second thought, it could be that multigrade classrooms have nothing to do with students'

decisions of staying at or leaving a school.

A surprising result is about electricity supply in schools. At 1% significance level, schools that use sources of electricity supply other than the public supply are expected to experience about 11 less student dropouts compared to schools that use public services. In fact, the dropout rate is expected to be 13 less students in schools that consume electricity from the private sector; while schools that use solar panels retain 13 more students, both compared to the public sector. More ironic is the fact those schools that do not have any power supply at all still retain 3 more students compared to schools that use public provision of electricity. This fact does not only provide an idea about the quality of the public provision of power in Mali, it also depicts issues of power supply in Malian schools. There are many schools that do not have any power supply in rural areas but students do not have much choice but to stay there.

Furthermore, this study provides interesting information about library availability and payments of school fees. At 1% significance level, schools that have libraries are expected to have 12 fewer dropouts compared to schools that do not. For school fee payments, I find the interesting and surprising result that students tend to leave schools that have no fees or do not collect fees on a consistent basis compared to schools that require fee payments. This behavior might not be an example of moral hazard, but the opposite of it. Because of the perceived free service, students may be tempted to not take their studies seriously. In sum, this study is packed with surprising and important findings about basic education in Mali, some of which are also corroborated by the Senegalese data.

Table 5 presents the estimation of equation (3) for literacy and mathematics using

the OLS estimation method. The first two columns present results for regressing French and math final scores, respectively, without accounting for school fixed effects. The last two columns repeat the estimations while accounting for school fixed effects. I find positive significant effects at conventional significance levels for completing the curriculum that needs to be taught in both mathematics and literacy. However, I do not find economic significant results because of the coefficient of the variable being small in magnitude when school effects are not accounted for. Nevertheless, when the latter is controlled for the math subject, the variable becomes significant at the 1% significance level. Its sign changes to negative and its magnitude gets larger. This result makes sense because the more advanced the topic covered in class, the harder it is to get good grades. The magnitude and sign stay the same for the French subject. This might be due to the fact that French is relatively easier for students compared to math. Another explanation could be that the French data may suffer from bias resulting from the fact that teachers themselves reported this information. If for some reason a teacher would not admit that he or she did not complete the curriculum, then results could be biased.

Regardless of whether school fixed effects are considered or not, results show that student final test scores in Mathematics and French are hindered if there are too many students sharing only one book. Interestingly, at 1% significance level, the French final score of a student who does not have any book is expected to obtain 23% less correct answers compared to a student who has a book for himself alone, and does not have to share with anyone.

Two other findings are worth mentioning concerning the Senegalese education. First, students who engage in farm work are expected to have 2.35% less correct answers

compared to their peers who do not do farm work. Second, there is strong evidence that students' pretest scores matter for their success at the finals.

Overall, the results were interesting and to a degree trustworthy for the Senegalese education. R-squared as high as 67.3% is a good indication that the model fits the data well. However, this should not be interpreted as credible as to the level of implying causality. In addition, various tests, including normality and multicollinearity (VIF) tests, did not show any problem, except for the heteroskedasticity test. This is true for both Senegal and Mali. The heteroskedasticity test revealed that both models suffer from hetereskedasticity problems. This is the reason why I corrected standard errors for both countries with robust standard errors. For both countries, I also tried different functional forms. For example, I tried the squared form of variable *percentprog*; but after all similar attempts, the models that are considered in this study were doing the best. These robustness checks are important because they provide more credibility to the interesting findings, which is crucial for policy recommendation.

TABLE 4: MALI REGRESSION RESULT

VARIABLES	(1) droprate	(3) droprate
shift	2.293*	2.381**
	(1.211)	(1.126)
multigrade	-0.643	-0.153
	(1.098)	(1.072)
exam	-0.0107***	-0.00411
	(0.00277)	(0.00278)
renov	4.568***	4.619***
	(0.945)	(0.903)
prigen	-7.015***	-6.380***
	(1.458)	(1.490)
private	-13.06***	-12.70***
	(2.137)	(2.225)
sol	-12.48***	-12.74***
	(1.824)	(2.717)
noelec	-2.881**	-3.026**
	(1.343)	(1.272)
otherelec	-11.89***	-10.65***
	(2.944)	(3.228)
lib	-11.92***	-11.76***
	(1.138)	(1.144)
maybefee	8.075**	7.548**
	(3.235)	(3.089)
nofee	5.311***	4.724***
	(1.274)	(1.270)
maybecoop	4.976***	5.213***
	(1.600)	(1.505)
nocoop	3.413**	4.103***
	(1.404)	(1.365)
outdefault	2.393	2.631
	(1.753)	(1.681)
staydefault	-4.605***	-3.450**
	(1.344)	(1.442)
otherdefault	10.03***	10.33***
	(1.380)	(1.273)
tsalary	2.74e-05***	2.64e-05***
	(5.93e-06)	(6.09e-06)
seat	-3.928***	-3.979***
	(1.107)	(1.039)
grade2		0.798
		(1.214)
grade3		1.227
		(1.125)

TABLE 4 CONTINUED: MALI REGRESSION RESULT

VARIABLES	(1) droprate	(3) droprate
grade4		2.179**
		(1.042)
grade5		3.453***
		(1.093)
grade6		14.30***
		(1.184)
grade7		2.603
		(3.184)
grade8		2.793
		(2.715)
grade9		17.59***
		(4.573)
area2		
Constant	5.596***	-2.059
	(1.511)	(1.725)
Observations	2,241	2,241
R-squared	0.106	0.191

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 5: SENEGAL REGRESSION RESULT

VARIABLES	(1) finscor	(2) finscorm	(3) finscor	(4) finscorm
iniscor	0.766***	-	0.669***	-
	(0.0194)	-	(0.0227)	-
male	0.292	1.514**	0.187	0.460***
	(0.612)	(0.659)	(0.582)	(0.0199)
tinvillage	0.0255	-0.721	2.161	2.270***
	(0.613)	(0.655)	(2.869)	(0.609)
stuperbook2	-1.925**	-	-15.57***	-
	(0.799)	-	(3.970)	-
stuperbook3	-2.754***	-	-11.14***	-
	(0.898)	-	(4.117)	-
stuperbook4	-4.739***	-	-14.66***	-
	(1.179)	-	(3.882)	-
stuperbook5	-3.698***	-	-23.29***	-
	(1.160)	-	(3.777)	-
stuperbook6	-0.956	-	-23.67***	-
	(1.757)	-	(4.372)	-
guideuse2	4.705**	-	-12.29*	-
	(2.272)	-	(6.620)	-
guideuse3	-3.113	-	-4.279	-
	(2.486)	-	(5.326)	-
guideuse4	-2.279**	-	-4.692	-
	(0.971)	-	(3.721)	-
guideuse5	-1.033	-	6.615	-
	(0.915)	-	(5.053)	-
percentprogd	0.0271*	0.0400**	0.0312	-13.90***
	(0.0160)	(0.0168)	(0.0352)	(3.485)
stufarm	-2.346***	-0.515	-1.707**	7.554
	(0.654)	(0.703)	(0.754)	(5.753)
iniscorm	-	0.535***	-	-3.512
	-	(0.0182)	-	(4.081)
stuperbookm2	-	-2.473***	-	-8.698*
	-	(0.902)	-	(4.617)
stuperbookm3	-	-6.966***	-	14.56***
	-	(1.077)	-	(5.397)
stuperbookm4	-	-6.150***	-	0.451
	-	(1.303)	-	(4.865)
stuperbookm5	-	-8.314***	-	-15.23***
	-	(1.123)	-	(5.859)
stuperbookm6	-	-4.674***	-	-2.935
	-	(1.171)	-	(3.555)
guideusem2	-	-9.217**	-	2.804

TABLE 5 CONTINUED: SENEGAL REGRESSION RESULT

VARIABLES	(1) finscor	(2) finscorm	(3) finscor	(4) finscorm
	-	(4.325)	-	(2.547)
guideusem3	-	1.681	-	5.139
	-	(2.714)	-	(5.038)
guideusem4	-	0.710	-	0.109**
	-	(0.870)	-	(0.0522)
guideusem5	-	2.912***	-	-2.254***
	-	(0.802)	-	(0.796)
Constant	13.92***	16.57***	27.74***	21.63***
	(1.822)	(1.874)	(5.878)	(5.334)
School FE	No	No	Yes	Yes
Observations	1,681	1,688	1,681	1,688
R-squared	0.538	0.435	0.673	0.612

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

CHAPTER 5

POLICY RECOMMENDATION AND CONCLUSION

Despite enormous efforts, there is a crying need for increasing the quality of basic education in developing countries, especially in Senegal and Mali. Education for all is a virtuous goal but it will defeat its own purpose and be void of any sense if it is generating semi-analphabets with doctorate diplomas. This is unfortunately what is happening in less developed countries. Coping methods such as not completing the totality of the curriculum (as in Senegal), double-shift (half-day education), and multigrade education endanger the quality of education and potentially lead to less qualified students. Regarding these students, they are confronted with fewer favorable options: either being pushed to the next grade or kept at the same level until they drop out by themselves or are kicked out of school. However, a lot has been done and there is hope and potential to redress the quality of education.

In light of the results discussed above, I was able to identify the weaknesses of the education systems in Senegal and Mali and guidelines for improvement. First, the importance of books and libraries should not be underestimated. The results found above regarding the significant effects of books are largely corroborated by other studies done on the subject. Therefore, policy makers should be creative, despite meager means, in order to provide students with books to read. Books are considered to be the least

expensive input but probably one of the most valuable item in students' tool kits (Michaelowa, 2001). As suggested elsewhere, "rolling libraries" is an alternative option to be pursued if need be.

In addition, double shifts and multigrade schooling could still be effective if certain measures are taken. Double shift schooling should not be encouraged even though it allows schools to get by. When schools engage in this practice, they should make sure they also upgrade the quality of the teachers. The solution for keeping up with quality education when practicing "shifts" also deals with increasing the quality and the number of teachers. As usually proposed as a solution, increasing the number of school days, say from 5 to 7, is a worthwhile endeavor but requires more teachers.

Furthermore, it is hard, if not naive, to talk about quality without investment. No avenues should be left unchecked when it comes to financing schools. Students' contributions should be encouraged, even if they pay only one penny. As shown above, if education is provided for free, students may not take it too seriously, which might increase the number of dropouts. School fees should be obligatory and collected with earnestness. In spite of other urgent needs, larger budgets should be allocated to education, with the provision of supervising and evaluating these investments.

Finally, this article provides a valuable contribution to the economics of education literature in many respects. It explores the effects of offering multigrade classrooms and shifts on students leaving schools in Mali. It increases our understanding of the developing world and the challenges they are facing. Some topics of importance that were missing in the above discussion include contractual teachers, student grade repetition, and corruption in the school system. Further research is needed regarding these

topics because it could be that a lot of money is being injected into the school system but it never reaches its destination. As econometric tools are getting increasingly sophisticated and data on Africa are on the rise, it is imperative to focus our interests on these issues in this part of the world.

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