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Determinants of Mathematical Educational Achievement in Cameroon

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Abstract

This article presents a quantitative analysis of the determinants of student scores on a standardized mathematics assessment in Cameroon, a sub-Saharan African country with Francophone and Anglophone school systems. Using the mathematics component of the 2014 Programme d'Analyse des Systèmes Educatifs de la CONFEMEN survey, we examined the importance of community, school and classroom resourcing, teacher attributes, student characteristics, and family circumstances. Our results generally suggest that both school and family factors play a role in determining student achievement in mathematics. We found that student mathematics scores are highest for males, younger students, non-grade repeaters, urban students, when teachers are better resourced, and when students come from well-off family situations with parents who are able to read. Analyses of sub-samples and an expanded sample (with interaction effects) generally corroborate these results but also reveal further differences, including between the Francophone and Anglophone school systems. Finally, the results indicate that the kindergarten program is not systematically associated with better mathematics test scores, suggesting that this policy may need further study and modification.

Introduction

Promoting inclusive and sustainable economic growth in Africa through human capital development that is underpinned by science, technology, and innovation is the first aspiration of the African Union's Agenda 2063. However, there is a growing recognition that countries in sub-Saharan Africa (SSA) are falling behind in Science, Technology, Engineering and Mathematics (STEM) education compared to the rest of the world. World Bank and Elsevier (2014) suggest that the relatively lower research output in SSA could be explained by a number of factors: "the low quality of basic education in science and math within SSA; a higher education system skewed towards disciplines other than STEM such as the humanities and social sciences" (p. 4).

Concerns around the quality of science and math education, however, likely apply to the general quality of schooling. As such, improving basic math and science outcomes in SSA will have a spillover effect on the overall educational quality of primary education and other levels of education.

This article extends Medu (2019), who investigated student-level performance on regional assessments of mathematics and language skills in Cameroon. We used more recent mathematics test scores to examine the role of five groups of explanatory variables on student performance: community conditions, school and classroom resources, teacher characteristics, student attributes, and family environment. We chose Cameroon for the case study mainly because of its dual-language schooling systems, which offer additional sources of variation within a single country context; French and English are also individually the languages of instruction in much of SSA. We focused on a single country case study since we are interested in identifying lessons relevant for policymakers, who operate within national educational systems. Though we focused on the Cameroon experience, some of these policy lessons may apply more broadly.

Country context

Cameroon is a lower-middle-income country in SSA with a current population (2021) of approximately 27 million. The population is growing at around 3%, and school-age children (ages 5-19) comprise 37% of the population, both well above the global averages of 1% and 25%. The majority of the population (58%) is located in urban areas (World Bank, 2022).

Portuguese explorers were the first modern Europeans to establish contact in the area, which became a focus of slave trading and missionary activity. The region was formally established as a German colony in 1884 but was divided into separate British and French colonies during the First World War. The larger, more populous, and more economically developed French Cameroun became independent in 1960, but a plebiscite the following year saw it joined by the Southern portion of British Cameroon to form a united, bilingual republic (Awasom, 2000). The initial federal structure was replaced by a unitary system in 1972, which has led to some discontent and calls for secession by some of the Anglophone population.

Roughly 80% of the population live in the eight Francophone regions, with the remainder in the two Anglophone regions (see Figure 1). The simple division based on official European languages obscures the linguistic reality of over 200 local languages and considerable ethnic and cultural diversity. It is a common feature in SSA for students to be educated in the language of their prior colonial ruler, which is often a student's second or third language. The two language-based school systems have maintained the traditions of their colonial administration, with the Francophone system being highly centralized relative to the Anglophone administrative structure. While several key differences between the two systems still exist today, both provide free primary education (see Fallwickl et al. (2021) and Medu (2019) for more information about the education sector administration).

Figure 1: Map of Cameroon showing the linguistic region. Source: https://wenr.wes.org/2021/04/education-in cameroon

During the 1970s and 1980s, Cameroon had one of the most effective education systems in Africa (World Bank, 2012). For example, in the early 1980s, the basic school enrolment rate in Cameroon was one of the highest in SSA. Primary education access and enrolment continue to be high in Cameroon, however, there are marked differences in educational outcomes across gender and geographic locations. In 2014 when the PASEC survey was conducted, PASEC (2016) noted that the primary completion rate in Cameroon was 74% on average (70% for girls and 78% for boys). Similarly, the completion rate for Priority Education Zones (Adamawa, East, Far North and North) was only about 64%.

In 2009, the government adopted Cameroon Vision 2035, a development framework geared towards making Cameroon "an emerging country, democratic and united in its diversity by 2035". Education is considered a crucial factor in achieving Cameroon Vision 2035 as outlined in the National Development Strategy 2020-2030 (Republic of Cameroon, 2020). In the education and training sector, the Government's vision is to promote an educational system where every young graduate is sociologically integrated, bilingual and competent in an area that is fundamental to the country's development.

The World Bank (2018) noted that Cameroon's education sector continues to face a number of structural issues, including regional and gender differences in access to basic

education; poor quality of basic education (resulting in part from shortage and poor distribution of teachers around the country); limited provision of early childhood development programs; weak sector management and governance (including inadequate sector coordination and planning); and poor sector financing, and internal inefficiency.

The Anglophone crisis, which arguably dates back to colonial times and can largely be attributed to the marginalization of the Anglophone minority, erupted in earnest in 2017 (after our sample period), and is now worsening the disparities and inequalities within the education system. In 2019, UNICEF reported that more than 855,000 children in the two Anglophone regions were out of school, some for about three years. The intensifying Boko Haram crisis, which began having more serious effects in the Far North of Cameroon in 2012, also continues to impact the education system, particularly those living in border areas close to Nigeria and Chad.

The insurgency intensified in 2014, the year of the PASEC survey in this study (Afu, 2019). This disruption may have affected our results, though it is unlikely that children caught in the violence would have been included in the survey. It does appear that students in the Far North and North regions of Cameroon do perform worse on test scores, though poorer outcomes may reflect the many disadvantages related to the relative remoteness of the area. Future surveys may help shed more light on the effects of the insurgency on scholastic achievement.

Cameroon has undergone a number of recent reforms (some involving international partnerships) focused on the education sector. For example, the Ministry of Basic Education (MINEDUB) undertook a massive reform of the nursery and primary school curricula that was implemented in the 2018/19 school year. Also, the World Bank Education Reform Support Project, geared towards promoting equitable access to quality basic education, was implemented in Cameroon in 2018 and is slated to be completed in 2026. While robust evaluations are currently not available, the expectation is that these reforms and others underway within the country will lead to tangible and sustainable improvements within the education sector as well as the broader economy in the near future.

Literature review

In general, two streams of determinant factors of educational achievement are reported in the literature: family factors and school factors. This strand of literature is rooted in a landmark study from the United States (Coleman et al., 1966), which suggested that family differences are very important in explaining variations in achievement across students. This assertion was disputed for developing countries by Heyneman and Loxley (1983). They argued that school effects were more important for student achievement in developing countries, referred to as the 'Heyneman-Loxely effect, Heyneman/Loxely effect, H/L effect or HL effect' (for example, Badr et al., 2012; Baker et al., 2002; Heyneman, 2015).

A number of studies have re-examined the Heyneman-Loxley effect over time and highlight the possibility of changes in the effect over time. For example, Baker et al. (2002) reported a vanishing HL effect cross-nationally and proposed a number of explanations for the diminishing effect, including the level of school development as well as the availability and quality of school resources. In general, they noted their results "demonstrate how institutions of family and school interact over time because of changing macrosocial conditions… a third powerful institution, the nation-state,… changes the conditions under which the family and the school articulate achievement and status reproduction" (p. 310). Also, Zumbach (2010) suggested that the effect did not apply unconditionally, though it is more pronounced for SSA countries with higher levels of development.

The literature on determinants of educational quality is quite rich and has been subject to numerous reviews over the years (for example, Gleewe et al., 2011; Hanushek, 2003, 1997; Simons & Leigh, 1975). Fehrler et al. (2009, p. 4) provided a useful summary of the general literature:

> We conclude that despite rather discouraging evidence on the international level, for developing countries in general, and for most of the very poor sub-Saharan African countries in particular, school resources still play an important role in improving education quality. However, even for these countries, the estimated relationship between school resources and student achievement is far from consistent across studies, so that there is no easy recipe for successful policy interventions.

Recent reviews of the African literature highlight the importance of school-based factors and teacher ability. For example, some prioritize teacher training to improve pedagogy, instructional techniques, and assessment strategies (Conn, 2017; Bethell, 2016). Evans and Acosta (2021) highlighted the importance of multi-pronged responses to promote educational access and quality, particularly structured pedagogical and teacher interventions, including teacher training, teacher coaching, semi-scripted lessons, learning materials and mother-tongue instruction. Focusing on mathematics specifically, Ngware et al. (2015) used Kenyan data to argue that the most critical factor in improving student abilities, especially for low-performing students, is the quality of instruction.

Other studies emphasize the pivotal role of family and cultural factors (Bethell, 2016). Jurdak (2014) examined 18 countries that participated in the 2003 Trends in International Mathematics and Science Study, including three SSA countries. The results showed that the differences in mathematics achievement and between-school equity in mathematics education can largely be accounted for by socioeconomic and cultural factors (such as ethnicity, language and religious differences).

Gruitjers and Behrman (2020) studied the relationship between family socioeconomic status and learning outcomes in 10 SSA countries using 2014 data from the Programme

d'Analyse des Systèmes Educatifs de la CONFEMEN (PASEC). Their main measure of learning outcomes was mathematics test scores. While results generally support the importance of school quality as a determinant of learning outcomes in low-income contexts (the 'Heyneman-Loxely effect'), they qualify their conclusion by highlighting the importance of family background in determining the school a child attends. As such, "Ignoring the association between family background and school quality omits an essential pathway through which socioeconomic (dis)advantage affects children's learning outcomes" (p. 272).

Finally, Allier-Gagneur and Gruijters (2021) re-assessed the Heyneman-Loxley hypothesis using the full 2014 PASEC dataset on all ten countries in the PASEC survey. Their main measure of learning outcome was mathematics test scores and they conducted a general dominance analysis. Their results did not support the existence of the HL effect and generally suggested that "both schools and families have a substantial impact on learning outcomes in low-income contexts… to reduce learning inequalities, it is not sufficient to provide schools with more and better resources. Policy makes also need to pay attention to students' experiences outside of and before school" (p. 13). It is good to note that our analysis differs from their study in terms of estimating technique, as well as in our focus on one country to examine specific conditions and policy instruments in more detail.

In general, the empirical findings on mathematics teaching in SSA remain inconclusive. The specific strengths and weaknesses of an education system are best identified separately for each country, even though the associated lessons may not apply specifically to other countries. We focus on Cameroon to identify specific targets for policy attention.

Empirical analysis

Conceptual framework, sample and variables

The economics of education is mainly based on a human capital production function. The model asserts that the educational achievement of a student is partly related to policy inputs that are to some extent directly controlled within the education system (including administrative structure, curricula, school resources, classroom characteristics, and teacher quality), and factors largely exogenous to the system (innate student ability, parent attributes, and family resources). While educational achievement is typically measured at specific time periods, knowledge acquisition is cumulative and past inputs do influence current levels of student achievement (Hanushek, 2007).

We used the 2014 PASEC mathematics assessment results for 3,817 Francophone and Anglophone grade six students in Cameroon as the dependent variable representing student achievement. In conjunction with testing in mathematics and language, questionnaires were also administered to students, teachers and principals to gather information on the general conditions of schooling and the background of students and teachers.

The 2014 PASEC student level assessment data Cameroon was provided by Conférence des Ministres de l'Éducation des États et gouvernements de la Francophonie (CONFEMEN) through a special request. PASEC's standardized assessments are conducted in 22 Francophone SSA countries by CONFEMEN. The 2014 assessments followed a significant methodological revision and was conducted in ten Francophone SSA countries (Benin, Burkina Faso, Burundi, Cameroon, Chad, Congo, Côte d'Ivoire, Niger, Senegal and Togo). The survey sample is representative of the various geographic regions covered by both sub-systems, including the far North despite the relatively high level of instability in the region during the survey period. PASEC (2016) notes that the school participation rate in the grade six assessment in both sub-systems was higher than the 80 percent minimum threshold for publishing and international comparison. Student participation in both systems was also closer to 90 percent. Also, PASEC (2017) notes that Cameroon is one of the countries that over-sampled segments of their population for the purpose of additional analysis.

The analysis does have some limitations. Using a single survey means that we are taking a snapshot from one year and cannot address intertemporal variation in student performance or circumstances. Second, our focus on numeracy ignores other important dimensions of cognitive competence, many of which do not easily lend themselves to standardized tests, though it can be argued that cognitive skills in mathematics and science may serve as a proxy for other skills (Wößmann, 2003). Finally, our analysis uses assessments from grade six students, so its findings apply directly only to primary education. Primary education is foundational and has important subsequent effects on knowledge and skills acquisition at higher levels of education. There is also a strong correlation between grade six completion and family socioeconomic status (Gruitjers & Behrman, 2020). Also Hanushek and Woessman (2011) provide a high-level summary of the key issues related to empirical identification of education production functions.

The performance of the pupils on the PASEC tests was estimated using plausible values. For each student, five plausible values are assigned, which were transformed so that the average was equal to 500 and the standard deviation to 100. According to Wu and Adams (2002):

> "The simplest way to describe plausible values is to say that plausible values are a representation of the range of abilities that a student might reasonably have... Instead of directly estimating a student's ability, a probability distribution for a student's ability is estimated… Plausible values are random draws from this (estimated) distribution for a student's ability" (cited in OECD, 2009, p. 43).

The estimation procedure regresses each plausible value (PV) against five groups of explanatory variables representing the characteristics of the community, classroom, teacher, student and family. Each group is represented by several variables, which are identified in equation 1 in Appendix 1; details of these variables are also provided in Appendix 1.

Several additional independent variables were also considered, including: teacher's absence, teacher's monthly salary, school budget per student and language spoken at home. However, these variables were excluded for a number of reasons, including coding issues, missing observations, and minimal variation in the sample. Preliminary tests indicated that their exclusion did not affect these results.

Estimation approach and results

The equation was estimated using Ordinary Least Squares Regression analysis was conducted using the STATA "pv" module designed to perform plausible value estimations. The module was created specifically (but not exclusively) for use with international achievement datasets such as the Organization for Economic Cooperation and Development (OECD)'s Programme for International Student Assessment and Programme for the International Assessment of Adult Competencies (for more information, see MacDonald, 2019).

Diagnostic tests did not reject the null hypothesis of normally distributed residuals (Shapiro-Francia test) and did not detect any significant problems of multicollinearity (all Variance Inflation Factors are under five). A Breusch-Pagan test for heteroscedasticity was inconclusive, but a comparison of the unweighted and weighted OLS results suggested that homoscedasticity was a reasonable assumption, so we reported only the unadjusted results.

The primary estimation used test scores for all students, with the explanatory variables organized according to community and classroom conditions, teacher attributes, student characteristics, and family situation. Table 1 presents the results for both the full estimating equation and a step-wise reduced version. The reduced model allows for a larger sample and a focus on the most interesting and robust results. Alternative specifications of the full model were also estimated based on sub-samples and interactions related to educational system, school location, student gender and kindergarten attendance. The coefficient estimates and their levels of statistical significance were generally consistent across the different estimations. Accordingly, the discussions are based on the reduced model results and significant effects from the alternate models. The discussion of the results is grouped based on the identified five groups of explanatory variables: community, classroom, teacher, student and family-related factors beginning with the reduced model findings.

Community-related variables

Community-level variables identify linguistic variation (Anglophone regions and Francophone regions), rural-urban distinctions, and a community development index. Only the rural-urban distinction affected math scores, with urban students averaging 71 points higher (representing about 15% of the sample average math score, and over 75% of a standard deviation). While location is not a policy variable, this result suggests that education authorities may want to investigate further the possible sources of rural-urban performance differentials (urban students are approximately 36% of the sample).

It is good to note that the rural-urban distribution of school in the PASEC sample shows that less than 40 percent of schools were located in urban areas. PASEC (2016) confirmed this distribution and noted that Cameroon was one of the three countries where the majority of pupils in the sample were educated in rural areas. It is also important to note the difficulty associated with comparing between the high-level PASEC definition of rural/urban areas, standardized across participating countries to enable comparison, and the definitions used by other international organizations such as the World Bank.

School and classroom-related variables

The different measures of school and classroom conditions include class size, multigrade class, a class resource index, mathematics textbook availability for students, and mathematics textbook and teaching guide availability for teachers. Only the availability of the textbook and the guidebook for teachers seemed to affect student math scores. When the teacher had a textbook, average student test scores were roughly 39 points higher; when teachers had a guidebook, student scores were over 20 points higher. In the sample, over 95% of teachers had the textbook, but fewer than 60% had the associated guidebook for mathematics.

Teacher-related variables

None of the teacher characteristics included in the study (gender, age, experience, training, qualifications, or employment classification) had a statistically significant association with student math performance. This result is both surprising and disappointing since they suggest that some key policy levers are not working well. Of particular note, teacher training and qualifications do not seem to be associated with better math performance by students, which may warrant further analysis to see how these processes can be improved, and whether their costs are warranted given their limited effectiveness.

Student-related variables

Not surprisingly, student characteristics are of great importance for math scores. Female students, on average, had math scores about 14 points lower than male students. Student age also matters. The youngest student in the sample was 8, and the oldest was 20; the average age was 12. Older students have either been out of school for a period of time or held back to repeat grades. For each additional year of age, math scores fall by over 8 points.

To confirm the age effect, an alternate specification of the full regression with only students between the ages of 10 and 15 was estimated and the results remained robust. The coefficients on both the student age and grade repetition remained negative and statistically significant. The results were not surprising as excluded students (those under 10

or over 15) only make up a small portion of the population, about five per cent. Results of this estimation are available upon request.

In addition to the age effect, repeating at least one grade is associated with a 24-point fall in test scores for mathematics. Both age and grade repetition are likely the best indicators, available in the data, of a student's inherent scholastic aptitude, and thus serve as a partial control for innate ability. While a student's natural knowledge and ability are widely considered an important determinant of final performance, arguably, the conclusion for older students and students who have repeated at least one grade is that this relationship is being moderated by other factors (for example, school absenteeism).

One policy-relevant result of concern is the absence of an association between preschool or kindergarten attendance and better performance on math scores. Parents and school boards might want to consider ways that kindergarten can better prepare students for future studies.

Family-related variables

Finally, family characteristics (parent reading ability and SES index) affected student performance. Having both parents able to read (63% of the sample) is associated with a 14-point higher score on the math evaluation, while each additional point on the family's SES index (which ranges from 17 to 88, with an average of 53) raises math scores by around one point. These effects are fairly small in magnitude but are quite consistent and statistically strong.

Table 1: Estimation results for the mathematics assessment plausible values.

	Full Model		Reduced Model	
Explanatory Variable	**Coefficients**	**P-Values**	**Coefficients**	**P-Values**
Francophone region	9.250	0.462	-	
Urban	72.364***	< 0.000	71.482***	< 0.000
Community Development Index	-0.625	0.465	-	
Class size	0.020	0.890	-	
Multigrade class	-9.981	0.357	-	
Class Resource index	-0.636	0.568	-	
No math textbooks available	-7.025	0.624	-	
One math textbook per student	18.087	0.287	-	
Teacher has the math textbook	34.705†	0.097	39.121***	0.001
Teacher has the math guidebook	22.800*	0.035	20.466***	0.009
Teacher is female	3.901	0.725	-	
Teacher's age	-0.828	0.472	-	
Teacher's years of teaching	0.527	0.717	-	
Teacher trained, one year or less	21.238	0.240	-	
Teacher trained, two years or more	21.561	0.212	-	
Teacher has a professional qualification diploma	-13.053	0.486	-	
Teacher has a civil service contract	6.297	0.676	-	
Teacher has been contracted privately	6.271	0.672	-	
Teacher is a volunteer	2.955	0.836	-	
Student is female	-15.473**	0.004	-13.601***	0.003
Student's age	-8.278***	< 0.000	-8.711***	< 0.000
Student attended kindergarten	5.796	0.340		
Student has repeated at least one grade	-23.918**	< 0.000	-24.283***	< 0.000
Student's parents are both to read	13.066*	0.043	14.137**	0.019
Socioeconomic Status Index	0.942*	0.028	1.144***	0.003
Constant	540***	< 0.000	470***	< 0.000
Observations	2,593		3,152	
Average R-squared	0.401		0.375	

***, **, *, † indicate statistical significance for one-tailed tests at the .01, .025,0.05 and 0.1 levels, respectively.

To further analyse these results, we examined regressions using sub-samples defined by language, gender, and location. We chose these three as being the most interesting from a policy perspective; future work could focus on other, even smaller, subsamples, though the reliability of the results would be affected by sample size. The Francophone-Anglophone analysis indicates several important distinctions. We reviewed each of these to identify inductively potentially useful associations that could better explain student performance and highlight potentially useful policy instruments. In the educational system sub-samples, we noted that the urban effect, positive in both systems, was stronger in the Francophone system. Francophone student scores were also generally higher when teachers were trained, equipped with textbooks and guidebooks, and private (as opposed to being volunteers or in the civil service). Francophone females did worse than males, and Anglophone students generally did worse when they had attended kindergarten or had older teachers.

In the gender sub-samples, the effects of teachers having textbooks and parents being able to read appeared to be important for only male students. Male Francophone students had higher scores than their Anglophone counterparts, and male students appeared to do better with younger teachers. Finally, there was some troubling evidence that male students did slightly worse when their teachers had received select professional qualifications.

The last sub-sample separated out rural and urban locations. The difference in the urban effect between educational systems was evident here, too, as Francophone students appeared to perform slightly better than Anglophones in urban areas but not rural ones. Grade repetition was negatively associated with both urban and rural math test scores, but the effect was more pronounced in urban areas. Although rural schools have lower community development indices, smaller average class sizes, more multigrade classes, and lower-class resource scores, none of these factors had statistically significant associations with test scores in math. Student access to textbooks had significant positive effects on math scores for rural students, as did the presence of textbooks and guidebooks for their teachers. Female teachers, and teachers with select years of training as well as parents' reading ability, were associated with higher math test scores for students in rural areas. Finally, the troubling evidence of select teacher professional qualifications being associated with lower math scores was also present but only for urban students.

Since these indicative results appeared only in some sub-samples and were not tested jointly, we created interactive variables to see which of these effects remained statistically significant in the expanded full-sample model. We tested several versions of the models to ensure robustness. The findings generally corroborate earlier results, provide greater nuance than those in Table 1, and reiterate some interesting areas for attention by policymakers.

The effect of student age, grade repetition and socio-economic status remained robust with signs and magnitudes similar to those reported in Table 1. However, we chose to focus this discussion on the interaction coefficients that were consistently significant in alternate estimations we conducted. The estimations showed that lower scores for females turned out to be the result of better performance by Francophone males. The positive effect of teachers having

the math textbook is particularly pronounced for male and Francophone students. The positive association between math scores and private teachers was only present in the Francophone system. Also, having older teachers negatively impacted math scores in the Anglophone system and the negative effect of grade repetition remained prominent for urban students.

Further, the effects of attending kindergarten continued to be mixed and troubling. For Francophone students, attending kindergarten was associated with an increase in math scores. By contrast, attending kindergarten was associated with a drop in math scores for Anglophone students. This result points to a potential problem with either the kindergarten programs in Anglophone areas or the factors associated with putting Anglophone children into kindergarten. Finally, a significant negative effect of select teacher professional qualifications on math scores for male or urban students was not evident in the expanded full sample model results.

Summary of results and policy implications

The full sample, sub-sample and expanded full sample results generate a number of policy-relevant observations. First, the results generally highlight a nuanced and complementary contribution of both school and family factors, corroborating cross-country evidence highlighting the pivotal role of both schools and families in determining learning outcomes in low-income countries (for example, Gruitjers & Behrman, 2020; Allier-Gagneur & Gruijters, 2021).

Second, results also suggested that addressing the urban-rural gap in basic class resources such as textbooks would seem worthwhile, though the quality of teacher material in the Anglophone system is worth reviewing. Third, the poorer performance of Anglophone students with older teachers and the superior performance of Francophone students highlight the need for a closer assessment of the differences in teacher factors (particularly, training, credentialing, experience, retention and renumeration) across educational systems to identify promising teacher-related policy levers.

Fourth, the negative effect of grade repetition speaks to the need to target disadvantaged groups with new methods and resources to reduce the extent to which they are being left behind. Fifth, the fact that kindergarten attendance seemed to have harmful effects on the Anglophone system suggests the need for a serious investigation as to the cause of such a statistical association.

Finally, the weaker performance of female students in math, a result often found elsewhere, identifies another potential target for education policy reform. More intriguing, however, is that the disparate performance between males and females actually appears to reflect the superior performance of Francophone males; sources of this advantage might be worth examining further to identify practices that may improve the scores of Anglophone and Francophone females.

Conclusion

Mathematics is a fundamental skill for students and a key determinant of national economic growth and well-being. Low-income countries, in particular, must use their limited resources efficiently in order to provide the best educational experience possible for their student population. Weaknesses in the system of mathematics education are likely to be country-specific, and our study of Cameroon identifies several areas of concern.

Using standardized test scores in mathematics from the PASEC assessment, our analysis generally indicated that both school and family factors matter. The results also revealed that educational system, gender and location each play a role in determining mathematics performance. Further, the results suggested that resources used for providing kindergarten require additional scrutiny, particularly in the Anglophone sector. While most teacher factors did not seem to be consistently associated with student performance, there was some evidence of differences in mathematics performance based on teacher age and type across education sub-systems.

Additional work is required to understand more completely the education production function in mathematics for Cameroon, especially longitudinal analyses. The PASEC assessment process also allows for more detailed comparative studies of countries to understand the common problems in mathematics education in SSA and to identify best practices that can inform all countries in the region.

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