

Determinants of Academic Performance in Private Non-Religious Secondary Education: Evidence from Côte d'Ivoire

Math Adjoua N'Zué Koménan¹, Félix Fofana N'Zué^{1,2}

¹Department of Economics and Management, NAYEBA International University of Dabou, Dabou, Côte d'Ivoire

²Department of Economics and Management, Felix Houphouët Boigny University, Abidjan, Côte d'Ivoire

Email: nzue.math@gmail.com, felix.nzue@gmail.com

How to cite this paper: Koménan, M. A. N., & N'Zué, F. F. (2026). Determinants of Academic Performance in Private Non-Religious Secondary Education: Evidence from Côte d'Ivoire. *Open Journal of Social Sciences*, 14, 618-646.

<https://doi.org/10.4236/jss.2026.1410029>

Received: September 6, 2026

Accepted: October 25, 2026

Published: October 28, 2026

Copyright © 2026 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

This study examines the determinants of academic performance in private non-religious secondary schools in Côte d'Ivoire using administrative data from all Regional Directorates of National Education and Literacy (DRENAs) for the 2020/2021 academic year. Based on the educational production function framework, it analyzes the relationship between school infrastructure, student composition, pedagogical organization, teacher characteristics, and success rates in the BEPC and Baccalaureate examinations. Ordinary Least Squares (OLS) and fractional logit estimates show that higher private schools density, higher student-to-teacher ratio (particularly at the upper-secondary level), and higher student-to-number of pedagogical groups ratio are negatively associated with academic performance. Higher female student-to-total number of students, is positively associated with academic performance. Teacher employment status also matters, with higher contractual teacher-to-total number of teachers ratio showing positive associations with examination outcomes. Whereas the ratios of permanent and civil servant teachers over total number of teachers are negatively associated with academic performance. The findings highlight the importance of quality assurance, effective school organization, girls' education, and teacher management policies in improving educational outcomes.

Keywords

Academic Performance, Private Secondary Education, Gender, Teacher Incentives, Educational Production Function, Côte d'Ivoire, Sub-Saharan Africa

1. Introduction

Education plays a fundamental role in fostering economic growth, social mobility, and human development. By enhancing individual skills and productivity, educational investment contributes to the accumulation of human capital and strengthens the long-term development prospects of nations (Becker, 1964; Hanushek & Woessmann, 2012). In developing countries, particularly in Sub-Saharan Africa, expanding access to education has been accompanied by growing concerns regarding the quality of learning outcomes. Despite substantial progress in school enrolment over the last two decades, many education systems continue to face a persistent gap between years of schooling and actual learning achievement, a phenomenon commonly referred to as “learning poverty” (World Bank, 2022; UNESCO, 2015).

Against this backdrop, the private education sector has emerged as an increasingly important component of educational provision. In many African countries, governments have encouraged private participation in education to accommodate rising demand and alleviate pressure on public institutions. Côte d'Ivoire provides a particularly relevant case. Since the introduction of educational outsourcing and public-private partnership mechanisms during the 1990s, private non-religious schools have expanded considerably and now represent a significant share of secondary education provision. This expansion has contributed to improved access to schooling, yet questions remain regarding the factors that explain differences in academic performance across private educational institutions.

The relationship between private schooling and educational outcomes remains a subject of considerable debate in the economics of education. Some studies argue that private schools outperform public institutions because of greater managerial autonomy, improved accountability, and stronger performance incentives (Tooley & Dixon, 2005; Kingdon & Teal, 2007). Other research, however, suggests that the apparent advantage of private schools largely disappears when student characteristics and family backgrounds are taken into account, indicating the presence of selection effects rather than superior institutional effectiveness (Muralidharan & Sundararaman, 2015). Consequently, understanding the determinants of academic performance within the private sector remains an important empirical and policy challenge.

A large body of literature has examined the factors influencing educational performance through the framework of the educational production function. This approach conceptualizes learning outcomes as the result of interactions among educational inputs, including infrastructure, teacher characteristics, school organization, and student composition (Hanushek, 2008). Empirical evidence suggests that while material resources may contribute to educational quality in resource-constrained environments, their effects are often contingent upon institutional conditions and instructional quality (Glewwe et al., 2011; Hanushek & Rivkin, 2010). In addition, increasing attention has been devoted to factors such as teacher incentives, gender disparities, and pedagogical organization, which may signifi-

cantly influence student achievement but remain insufficiently explored in many developing-country contexts.

Despite the growing international literature on school effectiveness, important gaps persist. First, empirical evidence on private secondary education in Sub-Saharan Africa remains relatively limited and is often based on localized surveys or specific regions rather than nationally representative datasets. Second, most studies examine a restricted set of determinants and rarely integrate infrastructural, demographic, pedagogical, and teacher-related factors within a unified analytical framework. Third, the roles of student gender composition and teacher employment status remain underexplored in African education systems, despite increasing policy interest in gender equality and teacher incentive structures. It results from the above the need to a better understanding of the factors affecting performance of private education.

This study seeks to address these gaps by examining the determinants of academic performance in private non-religious secondary schools in Côte d'Ivoire. Using administrative data covering all Regional Directorates of National Education and Literacy (DRENAs) during the 2020/2021 academic year, the study investigates how school infrastructure, student characteristics, pedagogical organization, and teacher composition are associated with success rates in the Brevet d'Études du Premier Cycle (BEPC) and Baccalaureate (BAC) examinations. The analysis is grounded in the educational production function framework and employs econometric techniques to estimate the relationships between key educational inputs and student outcomes.

The paper makes three principal contributions to the literature. First, it provides rare national-level evidence on the determinants of academic performance in private secondary education in Côte d'Ivoire, a context that remains largely underrepresented in empirical research. Second, it adopts an integrated analytical perspective by simultaneously examining infrastructural, demographic, pedagogical, and teacher-related factors. Third, it sheds new light on the roles of female student enrolment and teacher employment status, two dimensions that have received limited attention in the literature on educational effectiveness in Sub-Saharan Africa.

The findings indicate that school expansion and increasing enrolment pressures are negatively associated with examination performance, whereas female student enrolment and stronger pedagogical organization are positively associated with educational outcomes. The analysis also reveals heterogeneous relationships across different categories of teachers, highlighting the potential importance of incentive structures within private educational institutions. These findings contribute to ongoing debates concerning educational quality, private-sector participation, and human capital development in low- and middle-income countries.

The remainder of the paper is organized as follows. Section 2 reviews the relevant theoretical and empirical literature. Section 3 describes the data, variables, and empirical methodology. Section 4 presents the econometric results. Section 5

discusses the findings and their implications for educational policy and research. Section 6 concludes and outlines directions for future studies.

2. Literature Review

2.1. Theoretical Foundations of Educational Performance

Understanding the determinants of educational performance has long been a central concern in the economics of education and related social sciences. Academic achievement is generally viewed as the outcome of a complex interaction among school resources, student characteristics, institutional arrangements, and broader socioeconomic conditions. Three major theoretical perspectives have shaped the literature: the equity-efficiency approach, the educational production function framework, and the educational quality perspective.

Although these perspectives originate from different intellectual traditions, they provide complementary explanations of how educational outcomes are produced and why performance differences emerge across schools and education systems. Together, they offer a useful framework for analysing the determinants of academic performance in private secondary education.

2.1.1. Equity and Efficiency in Education

The debate on educational effectiveness has traditionally been framed around the relationship between equity and efficiency. The seminal Coleman Report (Coleman, 1966) argued that differences in student achievement are strongly influenced by students' family and social backgrounds, often more than by school resources themselves. This perspective suggests that educational outcomes cannot be fully understood without considering inequalities in educational opportunities.

Subsequent research has generated mixed evidence regarding the relative importance of schools and student characteristics. On the one hand, studies on private education argue that greater institutional autonomy, managerial flexibility, and stronger accountability mechanisms can improve efficiency and student outcomes (Kingdon & Teal, 2007; Tooley & Dixon, 2005). On the other hand, several studies demonstrate that the apparent performance advantage of private schools is substantially reduced once differences in student background and selection processes are taken into account (Muralidharan & Sundararaman, 2015). These findings suggest that school effectiveness is closely linked to the composition of the student body and the broader context in which institutions operate.

In Sub-Saharan Africa, where educational systems continue to face substantial inequalities in access, quality, and learning achievement, understanding the interaction between equity and efficiency remains particularly important. Educational outcomes are often shaped by disparities in socio-economic status, geographical location, and gender, making the assessment of school performance especially challenging (CONFEMEN, 2019).

2.1.2. The Educational Production Function Approach

The educational production function constitutes one of the most influential

frameworks in the economics of education. Drawing on traditional production theory, this approach conceptualizes schools as organizations that transform educational inputs into measurable outputs such as examination results, learning achievement, or graduation rates (Hanushek, 2008).

Educational inputs are commonly grouped into three categories. The first comprises physical resources, including classrooms, school infrastructure, textbooks, and educational materials. The second includes human resources, particularly teachers and school administrators. The third consists of student characteristics, such as prior achievement, gender composition, household background, and motivation.

A central finding of the educational production function literature is that educational resources do not affect outcomes uniformly. While some studies identify positive effects of infrastructure investments and reduced class sizes, others conclude that increases in educational spending alone do not necessarily translate into improved academic performance (Hanushek, 2011). Instead, teacher quality consistently emerges as one of the strongest determinants of student achievement (Hanushek & Rivkin, 2010).

The literature also highlights the importance of incentive structures. Duflo, Dupas and Kremer (2015) show that differences in contractual arrangements and accountability mechanisms can influence teacher effort and ultimately student learning outcomes. This finding is particularly relevant in developing countries, where teacher employment arrangements often vary considerably across institutions.

The educational production function framework therefore provides an appropriate conceptual basis for analysing how infrastructure, enrolment patterns, pedagogical organization, and teacher characteristics jointly influence educational performance in private schools.

2.1.3. Educational Quality and School Organization

Beyond resource-based explanations, another strand of literature emphasizes educational quality as a multidimensional concept involving teaching practices, school management, learning processes, and institutional effectiveness (Fullan, 2001). From this perspective, educational outcomes depend not only on the quantity of inputs available but also on how these inputs are organized and utilized within schools. Effective school leadership, pedagogical innovation, student engagement, and classroom management are often identified as critical determinants of learning outcomes (Sizer, 1992; Stenhouse, 1975).

Particular attention has been devoted to school organization and classroom conditions. Research suggests that excessively large class sizes may limit teacher-student interaction and reduce instructional effectiveness (Blatchford et al., 2011). Similarly, the internal organization of teaching groups may influence the ability of schools to monitor students and deliver individualized instruction.

Although these dimensions are difficult to measure directly in quantitative studies, they remain essential for understanding variations in academic perfor-

mance. Consequently, many empirical analyses use indicators such as examination pass rates, student-teacher ratios, and pedagogical group structures as proxies for broader educational quality.

2.2. Empirical Evidence on the Determinants of Educational Performance

The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire journals, and not as an independent document. Please do not revise any of the current designations.

2.2.1. Public and Private School Performance

A substantial body of research has compared the performance of public and private schools. Existing evidence, however, remains inconclusive. Several studies report that private schools outperform public schools in terms of academic achievement, often attributing this advantage to stronger incentives, greater flexibility in personnel management, and enhanced accountability mechanisms (Tooley & Dixon, 2005). In contrast, other studies find that these differences largely disappear after controlling for student background characteristics and selection effects (Muralidharan & Sundararaman, 2015).

The diversity of findings suggests that institutional context matters considerably. The effectiveness of private schools appears to depend not only on ownership status but also on regulatory quality, market conditions, teacher management practices, and student selection mechanisms (Patrinos et al., 2009). Consequently, determining the drivers of performance within private education systems remains an important area of investigation.

2.2.2. Student Composition and Educational Outcomes

Student characteristics constitute one of the most robust predictors of educational achievement. Numerous studies demonstrate that socio-economic status, prior learning achievement, household resources, and parental education significantly influence academic success (Glewwe et al., 2011). More recently, increasing attention has been given to gender-related dimensions of educational performance. Evidence from several countries indicates that girls frequently outperform boys in a variety of educational settings, particularly in language-based subjects and overall academic achievement (OECD, 2018). Researchers have attributed these differences to variations in study habits, behavioural patterns, motivation, and educational aspirations.

Despite growing international evidence, relatively little research has examined the relationship between gender composition and school-level academic performance in Sub-Saharan Africa. Understanding whether female enrolment contrib-

utes to improved educational outcomes therefore remains an important empirical question.

2.2.3. School Resources, Class Size, and Pedagogical Organization

The literature on school resources presents mixed findings. While some studies find positive relationships between educational investments and learning outcomes, others report weak or inconsistent effects once student characteristics are adequately controlled for (Hanushek, 2008). One area that has received considerable attention concerns class size and student-teacher ratios. Lower class sizes are expected to improve educational outcomes by increasing teacher attention and facilitating classroom management. Empirical evidence remains divided regarding the magnitude and consistency of these effects (Blatchford et al., 2011).

Recent empirical evidence suggests that classroom size remains an important determinant of educational outcomes. Using data from over 21,000 schools across 80 countries, Antoniou et al. (2024) found that increases in class size beyond critical thresholds are associated with lower and less predictable student achievement. Similarly, Wang and Calvano (2022) showed that larger classes reduce teacher-student interaction and student engagement, both of which are important predictors of academic success. Ogunyemi (2022) reported a significant negative effect of large class size on student achievement, while the meta-analysis by Genga-Ayiemba (2025) concluded that smaller classes generally improve academic performance through enhanced instructional quality and learner participation. Furthermore, Engida et al. (2024) demonstrated that high-quality instructional delivery and effective classroom management are positively associated with examination performance, suggesting that class-size effects may operate through their influence on teaching effectiveness.

Similarly, the role of pedagogical organization has attracted growing interest. Educational researchers argue that effective structuring of instructional groups can improve student supervision, strengthen pedagogical interactions, and enhance learning outcomes. Nevertheless, empirical evidence on this issue remains limited, particularly in African countries where administrative data are often scarce.

2.2.4. Teacher Characteristics and Incentive Structures

Among school-level factors, teacher quality is consistently identified as one of the most important determinants of student achievement. However, measuring teacher quality remains difficult because key dimensions such as motivation, pedagogical skills, experience, and effort are often unobservable. As a result, researchers frequently examine observable teacher characteristics, including qualifications, years of experience, and employment status. Recent studies have highlighted the importance of incentive structures, suggesting that differences in contractual arrangements and accountability mechanisms may affect teacher behaviour and performance (Duflo et al., 2015).

The evidence remains mixed. Some studies report superior performance among

contractual teachers due to stronger incentives and greater accountability, while others find limited differences once teacher qualifications and working conditions are considered. This unresolved debate is particularly relevant in African education systems, where multiple categories of teachers coexist within the same institutions.

2.3. Research Gap and Contribution of the Study

Despite significant advances in the literature, three important gaps remain. First, empirical evidence on the determinants of academic performance in private secondary education remains limited in Sub-Saharan Africa and is often based on localized case studies rather than nationally representative data. Consequently, relatively little is known about the factors associated with educational performance within private school systems at the national level.

Second, existing studies often focus on a narrow set of explanatory variables. Many analyses examine either infrastructure, student characteristics, or teacher-related factors separately, without accounting for the interactions among these dimensions. As a result, there remains limited evidence from integrated analytical frameworks that simultaneously consider school resources, student composition, pedagogical organization, and teacher characteristics.

Third, the roles of gender composition and teacher employment status remain insufficiently explored in African contexts. Yet these variables are increasingly important for educational policy, particularly in relation to gender equality, teacher management reforms, and educational quality improvement.

This study addresses these gaps by examining the determinants of academic performance in private non-religious secondary schools in Côte d'Ivoire using administrative data from all Regional Directorates of National Education and Literacy (DRENAs) for the 2020/2021 academic year. Adopting the educational production function framework, the analysis simultaneously considers infrastructure, enrolment characteristics, pedagogical organization, and teacher categories in explaining success rates in national examinations. In doing so, the study contributes new national-level evidence to the literature on educational effectiveness in Sub-Saharan Africa and provides policy-relevant insights into the functioning of private secondary education systems.

3. Data and Methodology

3.1. Data Source and Method of Analysis

This study draws on administrative data obtained from the Directorate of Studies, Statistics and Strategic Planning (DESPS) of the Ministry of National Education and Literacy of Côte d'Ivoire. The dataset covers all Regional Directorates of National Education and Literacy (DRENAs) for the 2020/2021 academic year and includes information on private non-religious secondary schools, educational infrastructure, teacher characteristics, pedagogical organization, and examination outcomes.

The analysis focuses on academic performance in the two principal national examinations: the *Brevet d'Études du Premier Cycle* (BEPC), which marks the completion of lower secondary education, and the *Baccalaureate* (BAC), which concludes upper secondary education. Using all DRENAs provides national coverage of the private non-religious secondary education sector and enables the examination of regional variations in educational performance and resource allocation.

The unit of analysis is the DRENA. School-level administrative records were aggregated by DESPS at regional level before analysis. This regional-level approach allows the study to capture variations in educational inputs and outcomes across administrative jurisdictions while relying on a nationally representative dataset. However, the use of aggregated data implies the loss of information regarding within-region heterogeneity among schools and students. Consequently, the estimated relationships should be interpreted as regional-level associations rather than school-level effects.

3.2. Variable Definitions

3.2.1. Dependent Variable

The dependent variable is academic performance, measured by examination success rates in the BEPC and BAC examinations at the DRENA level. Examination success rates are widely used in the economics of education as indicators of educational outcomes because they provide standardized measures of student achievement across administrative units. Although examination success does not fully capture all dimensions of educational quality, it remains one of the most reliable indicators available in administrative education datasets.

Two dependent variables are considered: BEPC Success Rate which is the percentage of candidates passing the national lower-secondary examination;

$$\text{BEPC Success Rate} = \frac{\text{Successful candidate from private non religious schools}}{\text{Number of candidates who sat the BEPC Examination}} \times 100 \quad (1)$$

and BAC Success Rate which is percentage of candidates passing the national upper-secondary examination.

$$\text{BAC Success Rate} = \frac{\text{Successful candidate from private non religious schools}}{\text{Number of candidates who sat the BAC Examination}} \times 100 \quad (2)$$

Estimating separate models for the two examinations makes it possible to examine whether the determinants of performance differ across educational cycles.

3.2.2. Explanatory Variables

Following the educational production function approach, explanatory variables are grouped into four categories: infrastructure variables, gender composition, pedagogical organization, and teacher characteristics.

Infrastructure Variables

Infrastructure indicators capture the physical capacity of the educational system. We used the ratio of number of schools over number of students. This ratio measures the availability of schools relative to the student population.

$$\text{Ratetablv}_i = \frac{\text{Number of Schools}_i}{\text{Number of Students}_i} \quad (3)$$

It can be interpreted as an indicator of school density or educational infrastructure coverage. A higher value means: More schools are available for a given number of students; Students are likely to be distributed across more institutions; Potentially smaller class sizes; Less congestion; and Better access to educational facilities. Whereas a lower value means: Fewer schools relative to the student population; possible overcrowding; and greater pressure on educational infrastructure.

Gender Composition

To distinguish gender composition from educational system size, the study employs the female-student share:

$$\text{Ratelv3efil}_i = \frac{\text{Number of female students taking the BEPC exam}_i}{\text{Total number of students taking the BEPC exam}_i} \quad (4)$$

This measure captures the proportion of female students rather than the absolute number of female enrolments and therefore avoids conflating gender composition with regional enrolment scale. This allows the analysis to explore whether gender composition is associated with educational outcomes.

Pedagogical Organization and Congestion Indicators

Educational organization and resource pressure are measured using: Number of pedagogical groups; Student-to-teacher ratio; Student-to-classroom ratio; Student-to-pedagogical-group ratio. These indicators reflect the intensity of educational supervision and the extent to which learning conditions may be affected by overcrowding or resource constraints. Higher ratios indicate greater congestion and potentially weaker educational supervision. Lower ratios are generally expected to improve instructional effectiveness, although empirical findings remain mixed.

Teacher Characteristics

This category includes variables related to staffing: Number of permanent teachers (employed permanently by private non-religious schools); Number of temporary civil servant teachers (who are public-sector teachers and temporarily employed by private non-religious schools); Number of non-civil servant contractual teachers (employed under private contractual arrangements without civil-service status). Distinguishing teachers by employment status provides an opportunity to examine the role of incentive structures and staffing arrangements in explaining differences in academic performance. The teacher characteristics indicators are: permanent teacher-to-total teachers ratio (*tarenspermi*); temporary civil servant teacher-to-total teachers ratio (*ratensvacfcti*); and non-civil servant contractual teacher to total teachers ratio (*ratensvacnfcti*). For consistency, variables included in BEPC estimations refer to lower-secondary institutions, whereas

variables included in BAC estimations refer to upper-secondary institutions.

3.3. Analytical Framework

The empirical analysis is grounded in the educational production function framework, which views educational outcomes as the result of combining various educational inputs. In this framework, academic performance is produced through the interaction of school infrastructure, student characteristics, teacher attributes, and pedagogical organization.

Formally, educational performance can be represented as:

$$Perf_i = f(I_i, S_i, P_i) + \varepsilon_i \quad (5)$$

where:

$Perf_i$ denotes academic performance in DRENA; I_i represents infrastructure-related variables; S_i denotes student and teacher characteristics; P_i refers to pedagogical organization variables; and ε_i is the stochastic error term. This framework assumes that educational outcomes are influenced jointly by the quantity and quality of resources available within the educational system.

3.4. Econometric Specification

To estimate the relationships between educational inputs and examination performance, the study employs Ordinary Least Squares (OLS) regression models. Given the substantial variation observed in educational resources across regions, the variables are transformed into natural logarithms. The log-linear specification offers several advantages. First, it reduces the influence of extreme observations. Second, it helps mitigate heteroscedasticity. Third, it allows estimated coefficients to be interpreted as elasticities, facilitating comparison across variables measured in different units. The baseline econometric specification is:

$$\ln(Perf_i) = \alpha + \sum_{k=1}^K \beta_k \ln(X_{ki}) + \varepsilon_i \quad (6)$$

where:

$Perf_i$ represents the examination success rate; X_{ki} denotes the set of explanatory variables; β_k measures the elasticity of academic performance with respect to each explanatory variable; ε_i captures unobserved factors affecting educational outcomes.

Separate regressions are estimated for BEPC and BAC performance in order to account for potential differences in the determinants of achievement across educational levels. Multiple specifications are also estimated to assess the stability of the results and reduce concerns related to model dependence.

The dependent variable is academic performance measured as the examination pass rate, and expressed as a proportion bounded between 0 and 1. While the main estimations would rely on OLS for ease of interpretation and comparability with the existing literature, a potential concern is that OLS does not explicitly account for the bounded nature of the dependent variable. To address this issue, we estimate a fractional-response logit model following Papke and Wooldridge (1996).

The fractional-response specification constrains predicted values to the unit interval and is therefore particularly appropriate for proportion data.

3.5. Empirical Strategy and Econometric Issues

3.5.1. Endogeneity Concerns

A key challenge in estimating educational production functions is the potential endogeneity of several explanatory variables. For example, higher-performing regions may attract additional students and teachers, creating reverse causality between educational inputs and examination outcomes. Similarly, omitted institutional or socioeconomic factors may simultaneously influence resource allocation and student achievement. Because suitable instrumental variables are not available in the dataset, the analysis does not attempt to establish causal effects. Instead, the estimated coefficients should be interpreted as statistical associations between educational inputs and academic performance.

3.5.2. Multicollinearity

Several explanatory variables, particularly enrolment measures, pedagogical groups, and teacher counts, are expected to be highly correlated because they increase together as educational systems expand. Such multicollinearity may reduce the precision of coefficient estimates and inflate standard errors. To mitigate this concern, we not only use alternative model specifications but we also estimated more parsimonious specifications. Examining the stability of coefficients across specifications provides an indication of the robustness of the principal findings.

3.5.3. Heteroscedasticity

Differences in the scale of educational systems across DRENAs may generate heteroscedasticity in the regression residuals. The logarithmic transformation of variables helps reduce this problem. In addition, model diagnostics are conducted to verify whether the assumption of constant error variance is satisfied. Where appropriate, heteroscedasticity-robust standard errors may be used to ensure reliable statistical inference.

3.6. Study Limitation

Several limitations should be acknowledged when interpreting the findings. First, the analysis relies on aggregated regional-level data, preventing the identification of school-level or student-level mechanisms that may shape educational outcomes. Second, the study is based on a single academic year and therefore does not capture changes over time. Third, several important determinants of educational performance, including household socioeconomic characteristics, parental education, prior student achievement, teacher experience, and pedagogical quality, are not available in the administrative records used for this analysis.

Finally, the relatively small number of regional observations limits the complexity of the econometric models that can be estimated. Consequently, the results should be viewed as evidence of associations rather than definitive causal relation-

ships. Nevertheless, the dataset provides a rare national perspective on private secondary education in Côte d'Ivoire and offers valuable insights into the factors associated with regional differences in academic performance.

4. Empirical Results

This section presents the empirical findings on the determinants of academic performance in private secular secondary schools in Côte d'Ivoire. The analysis proceeds in three stages. First, descriptive statistics are used to characterize regional differences in educational resources and examination outcomes. Second, bivariate correlations provide preliminary evidence regarding the relationships between explanatory variables and academic performance. Third, multivariate regression models and a fractional-response logit model identify the factors most strongly associated with success rates in the BEPC and Baccalaureate examinations. All results should be interpreted as statistical associations rather than causal relationships given the cross-sectional nature of the data and potential endogeneity concerns.

4.1. Descriptive Statistics

The descriptive statistics (**Table 1** and **Table 2**) reveal substantial heterogeneity across DRENAs in both educational resources and academic outcomes. Examination success rates vary considerably across regions, suggesting important differences in educational conditions and school effectiveness. For the BEPC examination, the average pass rate is approximately 35%, while the Baccalaureate pass rate averages about 20%, indicating a more demanding transition at the upper-secondary level.

Table 1. Descriptive statistics of the variables of interest for BEPC in private institutions.

Variable	Obs	Mean	Std. dev.	Min	Max
Number of establishments (etab)	36	58.97	51.22	1.00	215.00
Pedagogical group (grpeda)	36	590.83	582.05	8.00	2286.00
Number of students	36	27,024.08	27,844.11	415.00	109,404.00
Number of female students	36	12,566.14	13,670.14	188.00	55,245.00
Student-classroom ratio	36	40.64	6.79	26.00	55.00
Pupil - pedagogical group ratio	36	41.00	4.49	26.00	49.00
Number of permanent professors	36	118.81	169.33	0.00	897.00
Number of non-civil servant part-time professors	36	197.36	331.05	0.00	1445.00
Number of temporary civil servants	36	895.53	792.94	15.00	3689.00
Success rate for the BEPC Session 2021	36	34.86	11.59	19.43	68.59

Source: Author's calculation.

Table 2. Descriptive statistics of the variables of interest for the BAC in private institutions.

Variable	Obs	Mean	Std dev	Min	Max
etab	36	58.97	51.22	1.0	215.00
grpeda	36	282.64	278.35	6.00	1253.00
ratelvsal	36	40.64	6.80	26.00	55.00
ratelvgrpeda	36	41.00	4.50	26.00	49.00
elvtle	36	4044.83	4165.15	11.00	18,040.00
elvtlefil	36	1773.75	2098.05	7.00	9373.00
prof_perm_tot	36	118.81	169.33	0.00	897.00
ProfVacnfcttot	36	197.36	331.05	0.00	1445.00
Profvacfcttot	36	895.53	792.94	15.00	3689.00
res_bacpriv	36	0.20	0.07	0.06	0.38

Source: Author's calculation based on DESPS statistics.

Large regional disparities are also observed in the distribution of educational inputs. Considerable variation exists in the number of schools, student enrolment, pedagogical groups, and teacher categories. In contrast, student-to-classroom and student-to-pedagogical-group ratios exhibit relatively lower dispersion, suggesting the existence of common operational standards across regions. Overall, these patterns point to significant differences in the educational environment facing students and justify further investigation through econometric analysis.

To avoid multicollinearity among the variables, we transformed the original variables into ratios. We thus, generated the following new variables i.e. *ratelv3efil* as the ratio of female pupils over the total pupils by DRENA; *ratensperm* as the ratio of teachers with permanent status over total number of teachers; *ratensvacnfct* as the ratio of non-civil servant part-time teachers over total professors; and *ratetabelv* as the ratio of number of schools over number of students which is an indicator of school density or educational infrastructure coverage.

4.2. Correlation Analysis

The correlation analysis provides preliminary insights into the factors associated with academic performance. For both the BEPC (**Table 3**) and BAC (**Table A1** in the Annex) examinations success rates are positively and significantly correlated with the ratio of female pupils over the total pupils. These correlations suggest that student composition may play an important role in explaining regional differences in examination outcomes. However, we observe negative and significant correlation between success rate and the ratio of teachers with permanent status over total number of teachers.

4.3. Determinants of Academic Performance in the BEPC Examination

Table 4 reports the regression estimates for BEPC success rates. Across alternative

model specifications. several variables emerge as important predictors of academic performance.

Table 3. Bivariate correlation between BEPC variables of interest in private institutions.

	<i>res_bepc</i>	<i>ratetabel</i>	<i>ratioelvgrpeda</i>	<i>ratelv3efil</i>	<i>ratioelvsal</i>	<i>ratensperm</i>	<i>ratensvacnfct</i>	<i>ratensvacfct</i>
<i>res_bepc</i>	1.00							
<i>ratetabel</i>	−0.337**a (0.04)	1.00						
<i>ratioelvgrpeda</i>	−0.15 (0.38)	−0.43*** (0.01)	1.00					
<i>ratelv3efil</i>	0.50***b (0.02)	−0.42*** (0.01)	0.14 (0.41)	1.00				
<i>ratioelvsal</i>	−0.03 (0.87)	−0.74*** (0.00)	0.64*** (0.00)	0.16 (0.34)	1.00			
<i>ratensperm</i>	−0.30* (0.07)	0.02 (0.89)	−0.01 (0.96)	−0.39** (0.02)	−0.01 (0.96)	1.00		
<i>ratensvacnfct</i>	0.08 (0.63)	−0.06 (0.71)	0.05 (0.78)	−0.33** (0.05)	0.05 (0.78)	0.49*** (0.00)	1.00	
<i>ratensvacfct</i>	0.06 (0.71)	0.04 (0.83)	−0.03 (0.85)	0.40** (0.01)	−0.03 (0.85)	−0.77*** (0.00)	−0.933*** (0.000)	1.00

Source: Author's calculation based on DESPS statistics. Asterisks indicate coefficients that are significant. Thus, ***, **, * and represent significance at the thresholds of 1%, 5%, and 10% respectively, b the values in parentheses represent the p-value.

Table 4. Results of the estimation of the determinants of academic performance of private non-religious schools at the BEPC Examination Session 2021.

	specification 1	specification 2	specification 3	specification 4
	Coefficients			
<i>lnratetabelv</i>	−0.497* (0.098) ^b	−0.311 (0.134)	−0.383* (0.074)	−0.311 (0.127)
<i>lnratelgrpeda</i>	−1.064*** (0.007)	−1.078*** (0.006)	−1.061*** (0.008)	−1.081*** (0.005)
<i>lnratelv3efil</i>	0.865* (0.083)	1.039** (0.025)	1.094** (0.023)	0.984** (0.024)
<i>lnratioelvens</i>	−0.219 (0.376)			
<i>lnratensperm</i>	−0.125** (0.027)	−0.128** (0.023)	−0.112** (0.049)	−0.121** (0.022)
<i>lnratenvacfct</i>	−0.180 (0.533)	−0.115 (0.678)	−0.477** (0.025)	

Continued

lnratenvacnfct	0.121 (0.106)	0.131* (0.076)		0.153*** (0.004)
_cons	5.434*** (0.009)	6.436*** (0.000)	5.603*** (0.001)	6.501*** (0.000)
Observationss	33	33	33	33
F-statistics	4.69*** (0.002)	5.37*** (0.001)	5.29*** (0.002)	6.61*** (0.000)
Adj R-squared	0.446	0.450	0.401	0.467
Const. var. Test (B-P/C-W)	0.89 (0.347)	1.14 (0.287)	0.62 (0.432)	0.93 (0.334)
Mean VIF	2.61	2.21	1.60	1.51

Source: Author's calculation based on DESPS statistics. a Asterisks indicate coefficients that are significant. Thus, ***, **, * and represent significance at the thresholds of 1%, 5% and 10% respectively, b Values in parentheses represent the p-value.

Table 5. Results of the fractional logit estimation of the marginal effects of the determinants of academic performance of private non-religious schools at the BEPC Examination Session 2021.

	specification 1	specification 2	specification 3	specification 4
	dy/dx → Marginal effects			
lnratetabelv	-0.209**a (0.019)b	-0.137** (0.043)	-0.168** (0.014)	-0.137** (0.043)
lnratelgrpeda	-0.369*** (0.000)	-0.378*** (0.000)	-0.375*** (0.000)	-0.378*** (0.000)
lnratelv3efil	0.347** (0.023)	0.415*** (0.006)	0.448*** (0.005)	0.405*** (0.008)
lnratioelvns	-0.091 (0.153)			
lnratensperm	-0.041*** (0.005)	-0.042*** (0.004)	-0.035** (0.029)	-0.041*** (0.003)
lnratensvacfct	-0.046 (0.591)	-0.020 (0.816)	-0.162** (0.049)	
lnratensvacnfct	0.048** (0.025)	0.052** (0.019)		0.055*** (0.005)

Source: author's estimate. a Asterisks indicate significant coefficients. Thus, *, ** and represent 1%, 5% and 10% respectively, b The values in parentheses represent the p-value (probability value associated with Student's statistic of the significance test).

4.3.1. School Expansion and Educational Performance

One of the most consistent findings is the negative association between the ratio of number of schools over number of students (lnratetablv) and examination success. The estimated coefficients suggest that regions experiencing more school density tend to record lower BEPC pass rates. This result may reflect challenges associated with maintaining educational quality during periods of rapid growth including resource fragmentation and limitations in administrative oversight.

However, rather than indicating that school expansion (high school density) in a given region is undesirable, the finding suggests that the effectiveness of expansion depends on the capacity of educational authorities to ensure adequate supervision, staffing, and quality assurance mechanisms.

4.3.2. Gender Composition

The results indicate that the ratio of female pupils over the total pupils exhibits a robust positive and significant association with BEPC success rates. This finding remains statistically significant across specifications and represents one of the most notable results of the study. It suggests that regions with higher female participation in secondary education tend to achieve better academic outcomes. Although the data do not permit the identification of the underlying mechanisms, the result is consistent with international evidence indicating that girls often display stronger educational engagement and academic persistence.

4.3.3. Pedagogical Organization

The ratio of the number of pupils over the number of pedagogical groups emerges as a strong negative predictor of academic performance. Regions with higher ratio record better examination success rates. This finding highlights the importance of school organization and suggests that learning conditions may improve when teaching activities are structured into smaller or more manageable instructional units. The result also supports the view that organizational factors constitute an important dimension of educational quality beyond conventional measures such as infrastructure and enrolment.

4.3.4. Teacher Employment Status

The estimated coefficients reveal substantial variation across teacher categories. The ratio of non-civil servant contractual teachers display a positive and statistically significant association with examination success (specifications 2 and 4), whereas temporary civil servant teachers exhibit a negative association in all specifications. The effect of permanent teachers shows significant negative association with examination success. The results are robust to the use of a fractional-response estimator that explicitly accounts for the bounded nature of examination pass rates (**Table 5**).

These findings may reflect differences in incentive structures, accountability mechanisms, or working conditions across teacher categories. Although the available data do not allow direct observation of teacher effort or classroom practices, the results suggest that employment arrangements warrant closer attention in dis-

cussions of educational quality and teacher management. The mean variance inflation factor (VIF) is less than 5 indicating that multicollinearity is not a concern.

4.4. Determinants of Academic Performance in the Baccalaureate Examination

Table 6 and **Table 7** report the regression and fractional logit response estimates for the BAC examination which generally confirm the patterns identified for the BEPC while revealing additional insights regarding upper-secondary education.

Table 6. Result of the estimation of the determinants of academic performance of private non-religious schools in the BAC Examination Session 2021.

	specification 1	specification 2	specification 3	specification 4
	Coefficients			
Inratetabelv	-0.261*** ^a (0.000)	-0.247*** (0.000)	-0.256*** (0.000)	-0.239*** (0.000)
Inratelvens	-0.216*** ^b (0.000)	-0.225*** (0.000)	-0.199*** (0.000)	-0.215*** (0.000)
Inratelvsal	0-0.033 (0.474)			
Inrattlefil	0.192*** (0.009)	0.242*** (0.001)	0.213*** (0.003)	0.194** (0.010)
Inratelgrp~a	-0.179** (0.034)	-0.174** (0.011)	-0.214*** (0.002)	-0.190*** (0.006)
Inratensperm	-0.0176* (0.064)		-0.018* (0.054)	-0.014 (0.126)
Inratensvacnfct	0.015 (0.215)	0.011 (0.368)		0.027*** (0.003)
Inratensvacfct	-0.073 (0.147)	-0.046 (0.336)	-0.121*** (0.001)	
_cons	0.293 (0.227)	0.306 (0.231)	0.273 (0.256)	0.367 (0.137)
Observations	33	33	33	33
F-Statistics	17.29*** (0.000)	19.92*** (0.000)	22.86*** (0.000)	21.31*** (0.000)
Adj R-squared	0.803	0.780	0.804	0.792
Const. var. Test	0.26 (0.609)	0.10 (0.756)	0.10 (0.752)	0.24 (0.624)
Mean VIF	3.52	3.59	3.06	2.88

Source: Author's calculation based on DESPS statistics. ^a Asterisks indicate coefficients that are significant. Thus, *, ** and represent significance at the thresholds of 1%, 5% and 10% respectively, ^b Values in parentheses represent the p-value.

Table 7. Results of the fractional logit estimation of the marginal effects of the determinants of academic performance of private non-religious schools at the BAC Examination Session 2021.

	specification 1	specification 2	specification 3	specification 4
	dy/dx ==> Marginal effects			
Inratetabelv	-0.268*** (0.000) ^b	-0.266*** (0.000)	-0.265*** (0.000)	-0.245*** (0.000)
Inratelvens	-0.218*** (0.000)	-0.214*** (0.000)	-0.207*** (0.000)	-0.217*** (0.000)
Inratelvsal	-0.039 (0.257)			
Inrattlefil	0.162*** (0.001)	0.163*** (0.002)	0.177*** (0.000)	0.159*** (0.005)
Inratelgrpeda	-0.172*** (0.009)	-0.214*** (0.000)	-0.215*** (0.000)	-0.187*** (0.001)
Inratensperm	-0.017*** (0.003)	-0.018*** (0.000)	-0.018*** (0.001)	-0.013** (0.025)
Inratensvacnfct	0.009 (0.214)	0.008 (0.324)		0.023*** (0.001)
Inratensvacfct	-0.084** (0.042)	-0.091** (0.022)	-0.117*** (0.000)	

Source: Author's calculation based on DESPS statistics. a Asterisks indicate coefficients that are significant. Thus, *, ** and represent significance at the thresholds of 1%, 5% and 10% respectively, b Values in parentheses represent the p-value.

4.4.1. Infrastructure and Enrolment Effects

The ratio of the number of schools over number of students (Inratetabelv) remains negatively associated with academic performance across all specifications. The consistency of this relationship across educational levels strengthens the argument that rapidly increasing school density in some regions may create quality management challenges within the private education sector.

While increasing school density can broaden educational access, higher density in a region may also create additional organizational and pedagogical pressures. The findings therefore suggest that the benefits of expansion depend on the availability of complementary educational resources.

4.4.2. Class Size and Pedagogical Constraints

A particularly important finding concerns student-to-teacher (Inratelvens) and student-to-pedagogical group (Inratelgrpeda) ratios. Both indicators are negatively and significantly associated with BAC success rates across all specifications, implying that overcrowded instructional environments reduce examination performance. This result is consistent with the view that effective learning at the up-

per-secondary level requires sufficient teacher attention and adequate classroom conditions. The magnitude and consistency of these coefficients indicate that capacity constraints become especially important as students progress toward high-stakes examinations.

4.4.3. Gender and School Performance

Consistent with the BEPC analysis, the ratio of number of female students over the total number of students (*lnrattlefil*) is positively associated with Baccalaureate success rates. The fact that this relationship remains significant across both educational cycles suggests that gender composition is a particularly robust predictor of school performance in the Ivorian private secondary education sector. This finding contributes to the growing literature emphasizing the educational benefits associated with girls' participation and retention in secondary schooling.

4.4.4. Teacher Characteristics

The results again reveal differentiated associations across categories of teachers. Non-civil servant contractual teachers (*lnratensvacnfct*) exhibit positive associations with student achievement, whereas temporary civil servant teachers (*lnratensvacfct*) and permanent teachers (*lnratensperm*) tend to display negative associations in all specifications. Taken together, these findings suggest that teacher employment status may serve as a proxy for underlying institutional incentives, motivation structures, or management practices within private educational institutions.

4.5. Robustness of the Findings

The principal findings remain broadly stable across alternative model specifications. The results are robust to the use of a fractional-response estimator that explicitly accounts for the bounded nature of examination pass rates. This stability increases confidence in the reliability of the estimated relationships.

The models also exhibit satisfactory explanatory power, especially for the Baccalaureate examination, where adjusted R^2 values exceed 0.78 in most specifications. The mean variance inflation factor (VIF) is less than 5 indicating that multicollinearity is not a concern.

4.6. Summary of Findings

Several conclusions emerge from the empirical analysis. First, increasing density of private educational institutions is consistently associated with lower examination performance, highlighting the importance of balancing growth with quality assurance. Second, indicators of educational congestion, including high student-pedagogical group, student-to-teachers ratios are negatively associated with academic achievement. Third, female student-to-total student ratio is positively and robustly associated with examination success across both educational cycles. Finally, teacher employment status is systematically related to performance, suggesting that incentive structures may influence educational effectiveness.

Overall, the findings support the relevance of an educational production function framework and underscore the importance of considering infrastructural, demographic, organizational, and human-resource factors simultaneously when analysing academic performance in private secondary education.

5. Discussion

The objective of this study was to identify the factors associated with academic performance in private non-religious secondary schools in Côte d'Ivoire. Using the educational production function framework, the analysis examined the relationships between infrastructure, student composition, pedagogical organization, teacher characteristics, and examination success rates. The results offer important insights into the functioning of private secondary education and contribute to ongoing debates on educational quality, school effectiveness, and human capital development in Sub-Saharan Africa.

5.1. Education Expansion Does Not Automatically Improve Educational Quality

One of the most notable findings of this study is the negative association between the density of private schools ($\ln \text{ratetabelv}$) and academic performance. This result challenges the common assumption that expanding educational supply necessarily translates into better educational outcomes. While the rapid growth of private education has undoubtedly increased access to secondary schooling in Côte d'Ivoire, the findings suggest that increasing school density alone may be insufficient to guarantee improvements in educational quality.

This result is consistent with studies emphasizing that the effectiveness of private education depends not only on institutional ownership but also on governance capacity, quality assurance mechanisms, and regulatory oversight. [Patrinos et al. \(2009\)](#) and [Bold et al. \(2013\)](#) argue that private-sector expansion can generate positive outcomes only when accompanied by adequate monitoring and accountability frameworks. In the absence of such mechanisms, rapidly increasing school density may lead to resource fragmentation, uneven teaching quality, and weak supervision.

The findings therefore suggest that policymakers should place greater emphasis on quality regulation and performance monitoring rather than focusing exclusively on increasing school density. In this regard, educational quality appears to be as much an institutional challenge as a resource challenge.

5.2. Resource Constraints and Congestion Effects Remain Important

The negative association observed between high student-to-teacher ($\ln \text{ratelvens}$), number of school-to-student ($\ln \text{ratetabelv}$) ratios, and academic performance provides evidence of congestion effects within the private secondary education sector. These findings indicate that educational resources may become less effec-

tive when the number of students exceeds the capacity of schools to provide adequate supervision and individualized support.

This result is broadly consistent with the educational production function literature, which emphasizes the role of resource constraints in shaping learning outcomes. Although international evidence on class size effects remains mixed, numerous studies have found that overcrowded learning environments can adversely affect student achievement, particularly in contexts where educational resources are limited (Hanushek, 2008; Blatchford et al., 2011).

Importantly, the results suggest that the challenge facing private education in Côte d'Ivoire is not simply one of access but also one of capacity. As enrolment continues to expand, maintaining favourable student-teacher ratios and adequate learning conditions becomes increasingly important for sustaining educational quality. This finding is particularly relevant given the growing demand for secondary education throughout West Africa.

5.3. Gender Composition and Academic Performance

A particularly significant contribution of this study is the robust positive association between female student enrolment and examination success rates. This relationship remains consistently positive across both the BEPC and Baccalaureate models, suggesting that gender composition is an important predictor of school performance.

This finding aligns with a growing body of international evidence indicating that girls frequently achieve stronger educational outcomes than boys. OECD (2018), for example, documents that, female students often display higher levels of academic engagement, persistence, and school discipline. Although the present study does not directly observe behavioural mechanisms, the results are consistent with these explanations.

The finding is particularly important in the context of Sub-Saharan Africa, where empirical evidence on the relationship between gender composition and school performance remains relatively limited. It suggests that policies promoting girls' access to and retention in secondary education may generate benefits that extend beyond equity considerations alone. Greater female participation in education may also contribute to improvements in overall school performance and educational effectiveness. Consequently, the results support ongoing national and regional efforts aimed at strengthening girls' educational participation as part of broader human capital development strategies.

5.4. Pedagogical Organization as a Driver of Educational Quality

The analysis reveals that the number of student-to-number of pedagogical groups ratio is negatively associated with academic performance across most specifications (lnratelgrpeda). This result highlights the importance of school organization as a determinant of educational effectiveness. While education policy discussions frequently focus on physical infrastructure or teacher recruitment, less attention

is often devoted to how teaching activities are organized within schools. The present findings suggest that pedagogical organization may play an important role in facilitating effective instruction and student monitoring. A lower ratio may create opportunities for more focused supervision, improved classroom interactions, and enhanced learning conditions.

This finding provides empirical support for the educational quality perspective, which emphasizes that learning outcomes depend not only on the quantity of resources available but also on how those resources are managed and deployed within educational institutions (Fullan, 2001). It further suggests that relatively low-cost organizational reforms may offer opportunities to improve educational outcomes even in resource-constrained settings.

5.5. Teacher Employment Status and Incentive Structures

The differentiated effects associated with teacher categories constitute one of the most original findings of the study. The results indicate that non-civil servant contractual teachers are generally associated with better academic outcomes, whereas temporary civil servant teachers and permanent teachers exhibit less favourable associations with examination performance.

These findings resonate with theories emphasizing the importance of incentives in shaping teacher behaviour and performance. Duflo, Dupas, and Kremer (2015) argue that contractual arrangements can influence teacher effort by strengthening accountability and linking performance more closely to employment outcomes. The positive association identified in this study may therefore reflect incentive effects operating within private educational institutions.

At the same time, caution is warranted in interpreting these results. Teacher status may also capture differences in qualifications, experience, workload, school assignment practices, or working conditions that are not observed in the available data. Consequently, the findings should not be interpreted as evidence that one teacher category is inherently superior to another. Rather, they suggest that institutional incentives and teacher management practices deserve greater attention in future research and policy discussions.

5.6. Implications for Educational Theory

The findings provide support for the educational production function framework by demonstrating that academic performance is associated with a combination of infrastructural, demographic, organizational, and human-resource factors. No single category of input appears sufficient to explain educational outcomes independently. Instead, examination performance reflects the interaction of multiple dimensions of the educational process.

More importantly, the results suggest that organizational and institutional factors may be at least as important as traditional resource measures. While infrastructure and staffing remain relevant, variables such as pedagogical organization, student gender composition, and teacher employment status emerge as particu-

larly influential. These findings reinforce recent arguments that educational quality depends not only on the availability of resources but also on the incentives, management practices, and institutional arrangements that govern their use.

5.7. Policy Implications

Several policy implications emerge from the analysis. First, the continued expansion of private secondary education should be accompanied by stronger quality assurance and regulatory mechanisms to ensure that growth does not undermine educational standards. Second, efforts to reduce overcrowding and improve student supervision remain essential for enhancing academic performance. Third, policies aimed at increasing girls' participation and retention in secondary education should be viewed not only as equity interventions but also as investments in educational quality and human capital development.

Furthermore, the positive role of pedagogical organization suggests that school management practices should receive greater attention within educational reform strategies. Finally, the differentiated associations observed across teacher categories highlight the need to strengthen teacher motivation, accountability, and performance management systems within the private education sector.

Overall, the evidence suggests that improving educational outcomes in private secondary schools requires a comprehensive approach that combines effective regulation, adequate resources, sound pedagogical organization, and well-designed teacher incentive structures. Such an integrated strategy is likely to be more effective than policies focusing on any single dimension of the educational system.

6. Conclusion

This study examined the determinants of academic performance in private non-religious secondary schools in Côte d'Ivoire using administrative data covering all Regional Directorates of National Education and Literacy (DRENAs) during the 2020/2021 academic year. Drawing on the educational production function framework, the analysis investigated the relationships between school infrastructure, gender composition, pedagogical organization, teacher employment status, and success rates in the BEPC and Baccalaureate examinations.

The findings reveal that academic performance in private secondary education is associated with a combination of institutional, demographic, pedagogical, and human-resource factors. First, the results show that the expansion of private educational establishments is negatively associated with examination success rates. This finding suggests that increasing the number of institutions, while important for improving access to education, does not automatically translate into better educational outcomes. Rather, educational expansion appears to require effective quality assurance mechanisms and adequate institutional oversight to ensure that rising enrolment is accompanied by sustained improvements in learning conditions.

Second, the analysis highlights the importance of resource constraints and ed-

educational congestion. Larger student populations and higher student-resource ratios are generally associated with lower academic performance, particularly at the upper-secondary level. These findings indicate that the quality of educational provision depends not only on access but also on the capacity of schools to provide adequate supervision and effective learning environments.

Third, the study identifies a robust positive association between female student-to-total student ratio and examination performance. This result contributes to the growing body of evidence highlighting the importance of gender dynamics in educational achievement. Beyond its implications for educational equity, the finding suggests that strengthening girls' participation and retention in secondary education may contribute positively to overall school performance and human capital development.

Fourth, the results emphasize the role of pedagogical organization in shaping educational outcomes. The finding suggests that effective organization of teaching and learning processes can enhance school performance. This finding underscores the importance of management and instructional arrangements as components of educational quality.

Finally, the analysis reveals differentiated associations across teacher categories. The contrasting relationships observed between contractual, temporary, and permanent teachers suggest that employment conditions and incentive structures may influence educational outcomes. Although the available data do not allow the identification of the precise mechanisms involved, the results point to the importance of teacher management policies in shaping school effectiveness within the private education sector.

This study makes an important contribution to the literature on education in Sub-Saharan Africa. By using nationally representative administrative data, it provides rare empirical evidence on the determinants of academic performance in private secondary education in Côte d'Ivoire. Moreover, it adopts an integrated analytical framework that simultaneously considers infrastructure, student composition, pedagogical organization, and teacher characteristics, thereby offering a more comprehensive understanding of school performance than is typically available in the existing literature.

Nevertheless, several limitations must be acknowledged. The analysis relies on aggregated regional-level data, which prevents the identification of school-level and student-level mechanisms. In addition, the cross-sectional nature of the dataset limits the capacity to examine changes over time and precludes causal inference. Important variables, such as household socioeconomic characteristics, prior student achievement, teacher experience, and measures of instructional quality, were not available in the administrative records used for this study. Consequently, the results should be interpreted as evidence of statistical associations rather than causal effects.

Future research could extend this analysis in several directions. The use of longitudinal datasets would make it possible to investigate the dynamics of educa-

tional performance and strengthen causal identification. School-level and student-level data could also provide deeper insights into the mechanisms through which gender composition, pedagogical organization, and teacher incentives influence learning outcomes. Finally, mixed-methods approaches combining quantitative analysis with qualitative investigations of school management and classroom practices could enrich our understanding of educational effectiveness in private secondary education.

In conclusion, the findings suggest that improving academic performance in private secondary schools requires more than the expansion of educational provision. Sustainable improvements in learning outcomes depend on the combined effects of effective regulation, adequate educational resources, sound pedagogical organization, gender-inclusive educational policies, and teacher management systems that foster motivation and accountability. As private education continues to expand across Côte d'Ivoire and other African countries, these factors will play a critical role in ensuring that increased access is matched by meaningful improvements in educational quality and student achievement.

7. Directions for Future Research

This study provides important insights into the determinants of academic performance in private secondary education in Côte d'Ivoire, but several areas warrant further investigation. First, future research should employ longitudinal or panel data covering multiple academic years to better assess how changes in school resources, organization, and teacher characteristics affect student outcomes over time and to control for unobserved heterogeneity.

Second, greater attention should be given to school-level and student-level analyses. While regional data offer a national overview, they conceal important variations across schools and learners. More disaggregated data would allow researchers to examine the influence of factors such as socioeconomic background, parental education, prior achievement, attendance, and motivation.

Third, future studies should adopt stronger causal identification strategies, including instrumental variables, propensity score matching, difference-in-differences, regression discontinuity designs, or experimental approaches. Such methods would help distinguish causal effects from simple correlations.

Fourth, the role of teacher quality and incentive structures deserves deeper examination. Detailed information on qualifications, experience, pedagogical skills, motivation, absenteeism, and remuneration would provide greater insight into the mechanisms linking teacher characteristics to student performance.

Fifth, the positive relationship between female student-to-total student ratio and academic achievement should be further explored to determine the contribution of behavioural, social, and institutional factors. Research should also investigate the influence of school governance, leadership, accountability systems, and financial management on educational quality.

Finally, mixed-methods approaches combining quantitative and qualitative ev-

idence could enrich understanding of the institutional and behavioural processes underlying educational outcomes. Such research would support the development of more effective, evidence-based policies to improve educational quality and student achievement in Côte d'Ivoire and across Sub-Saharan Africa.

Acknowledgements

The authors would like to thank the initial anonymous reviewer for his comments. We are solely responsible for any remaining errors.

Author Contributions

The paper was extracted from the 1st author's Master thesis. Data curation, review, editing, and supervision were done by 2nd author. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Antoniou, F., Alghamdi, M. H., & Kawai, K. (2024). The Effect of School Size and Class Size on School Preparedness. *Frontiers in Psychology*, 15, Article ID: 1354072. <https://doi.org/10.3389/fpsyg.2024.1354072>
- Becker, G. S. (1964). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. University of Chicago Press.
- Blatchford, P., Bassett, P., & Brown, P. (2011). Examining the Effect of Class Size on Classroom Engagement and Learning. *Educational Economics*, 19, 1-20.
- Bold, T., Kimenyi, M., Mwabu, G., Alice Ng'ang'a, A., & Sandefur, J. (2013). *Scaling up What Works: Experimental Evidence on External Validity in Kenyan Education*. World Bank Policy Research Working Paper. <https://doi.org/10.2139/ssrn.2241240>
- Coleman, J. S. (1966). *Equality of Educational Opportunity*. U.S. Government Printing Office.
- CONFEMEN (2019). *CONFEMEN Education Systems Analysis Program (PASEC 2019): Report on the Quality of Education Systems in Francophone Sub-Saharan Africa*. CONFEMEN.
- Dufló, E., Dupas, P., & Kremer, M. (2015). School Governance, Teacher Incentives, and Pupil-Teacher Ratios: Experimental Evidence from Kenyan Primary Schools. *Journal of Public Economics*, 123, 92-110. <https://doi.org/10.1016/j.jpubeco.2014.11.008>
- Engida, M. A., Iyasu, A. S., & Fentie, Y. M. (2024). Impact of Teaching Quality on Student Achievement: Student Evidence. *Frontiers in Education*, 9, Article ID: 1367317. <https://doi.org/10.3389/feduc.2024.1367317>
- Fullan, M. (2001). *The New Meaning of Educational Change* (3rd ed.). Teachers College Press.
- Genga-Ayiamba, J. (2025). A Meta-Analysis of the Impact of Class Size on Academic Performance in Secondary and Higher Education. *International Journal of Research and Innovation in Social Science*, 9, 2966-2969. <https://doi.org/10.47772/ijriss.2025.903sedu0224>

- Glewwe, P., Hanushek, E. A., Humpage, S., & Ravina, R. (2011). *School Resources and Educational Outcomes in Developing Countries: A Review of the Literature from 1990 to 2010*. NBER Working Paper, No. 17554.
- Hanushek, E. A. (2008). Education Production Functions. In S. N. Durlauf, & L. E. Blume (Eds.), *The New Palgrave Dictionary of Economics* (pp. 1-5). Palgrave Macmillan UK. https://doi.org/10.1057/978-1-349-95121-5_1930-1
- Hanushek, E. A. (2011). The Economic Value of Higher Teacher Quality. *Economics of Education Review*, 30, 466-479. <https://doi.org/10.1016/j.econedurev.2010.12.006>
- Hanushek, E. A., & Rivkin, S. G. (2010). Generalizations about Using Value-Added Measures of Teacher Quality. *American Economic Review*, 100, 267-271. <https://doi.org/10.1257/aer.100.2.267>
- Hanushek, E. A., & Woessmann, L. (2012). Do Better Schools Lead to More Growth? Cognitive Skills, Economic Outcomes, and Causation. *Journal of Economic Growth*, 17, 267-321. <https://doi.org/10.1007/s10887-012-9081-x>
- Kingdon, G. G., & Teal, F. (2007). Does Performance Related Pay for Teachers Improve Student Performance? Some Evidence from India. *Economics of Education Review*, 26, 473-486. <https://doi.org/10.1016/j.econedurev.2006.02.007>
- Muralidharan, K., & Sundararaman, V. (2015). The Aggregate Effect of School Choice: Evidence from a Two-Stage Experiment in India. *The Quarterly Journal of Economics*, 130, 1011-1066. <https://doi.org/10.1093/qje/qjv013>
- OECD (2018). *The ABC of Gender Equality in Education: Aptitude, Behaviour, Confidence*. OECD Publishing.
- Ogunyemi, K. O. (2022). Class Size and Self-Esteem as Determinants of Student Learning Outcomes in Essay Writing. *Journal of Educational Research and Practice*, 12, 148-159. <https://doi.org/10.5590/jerap.2022.12.1.11>
- Papke, L. E., & Wooldridge, J. M. (1996). Econometric Methods for Fractional Response Variables with an Application to 401(k) Plan Participation Rates. *Journal of Applied Econometrics*, 11, 619-632. [https://doi.org/10.1002/\(sici\)1099-1255\(199611\)11:6<619::aid-jae418>3.0.co;2-1](https://doi.org/10.1002/(sici)1099-1255(199611)11:6<619::aid-jae418>3.0.co;2-1)
- Patrinos, H. A., Barrera-Orsorio, F., & Guaqueta, J. (2009). *The Role and Impact of Public-Private Partnerships in Education*. The World Bank. <https://doi.org/10.1596/978-0-8213-7866-3>
- Sizer, T. R. (1992). *Horace's School: Redesigning the American High School*. Houghton Mifflin.
- Stenhouse, L. (1975). *An Introduction to Curriculum Research and Development*. Heinemann.
- Tooley, J., & Dixon, P. (2005). Private Education Is Good for the Poor: A Study of Private Schools Serving the Poor in Low-Income Countries. *Cato Journal*, 25, 335-352.
- UNESCO (2015). *Education for All 2000-2015: Achievements and Challenges*. UNESCO.
- Wang, L., & Calvano, L. (2022). Class Size, Student Behaviors and Educational Outcomes. *Organization Management Journal*, 19, 126-142. <https://doi.org/10.1108/omj-01-2021-1139>
- World Bank (2022). *The State of Global Learning Poverty: 2022 Update*. World Bank.

Annex

Table A1. Bivariate correlation between BAC variables of interest in private institutions.

	res_bacpriv	ratetabelv	ratelvsal	ratelvgrpeda	elvtlefil	ratensperm	ratensvacnfct	ratensvacfct
res_bacpriv	1.000							
ratetabelv	−0.215 (0.207)	1.000						
ratelvsal	−0.201 (0.240)	−0.060 (0.730)	1.000					
ratelvgrpeda	−0.182 (0.289)	−0.361** (0.031)	0.638*** (0.000)	1.000				
elvtlefil	0.431*** (0.009)	−0.300** (0.075)	0.221 (0.195)	0.331** (0.049)	1.000			
ratensperm	−0.385** (0.020)	−0.052 (0.764)	0.040 (0.819)	−0.009 (0.956)	−0.092 (0.595)	1.000		
ratensvacnfct	−0.111 (0.517)	0.080 (0.643)	0.036 (0.836)	0.049 (0.775)	0.195 (0.255)	0.493*** (0.002)	1.000	
ratensvacfct	0.240 (0.158)	−0.037 (0.831)	−0.042 (0.806)	−0.032 (0.853)	−0.104 (0.545)	−0.773*** (0.000)	−0.933*** (0.000)	1.000