Role of institutional quality in the public education financing–educational quality nexus: evidence from Sub-Saharan Africa

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Abstract

Purpose – This paper investigates the moderating role of institutional quality in the relationship between public education financing and educational quality in Sub-Saharan Africa (SSA).

Design/methodology/approach – This paper uses a two-step system generalised method of moments (GMM) to investigate the dynamic relationships among the variables using data from the World Bank covering the periods 2002–2020 for 46 SSA countries.

Findings – The results show that institutional quality moderates the effect of public education financing on educational quality at SSA's primary, secondary and tertiary levels. This finding shows that improved institutional quality enhances the effectiveness of public educational investments.

Practical implications – The findings of this study imply that policymakers seeking to enhance educational quality must not only increase educational investments but also institute measures to improve institutional quality.

Originality/value – Prior studies fail to examine the moderating role of institutional quality in the nexus between public education financing and educational quality. This study analyses the role of institutional quality in the public education financing–educational quality nexus in SSA. The findings of this study contribute to improving the return on public education financing in SSA.

Keywords Public education financing, Educational quality, Institutional quality, Sub-Saharan Africa, System GMM

Paper type Research paper

1. Introduction

Education, which has both personal and public benefits (Fomba *et al.*, 2023), is undoubtedly a powerful tool for achieving economic development (Danquah and Amankwah-Amoah, 2017; Adeniyi *et al.*, 2021) and is therefore critical for closing the wealth and poverty gap (Hannum and Buchmann, 2005). Education is so vital that it is prominent in most multilateral and

bilateral development-oriented programmes. Goal four of the Sustainable Development Goals (SDG4) targets improving the quality of education.

Market failures frequently characterise economies' social sectors, such as education and healthcare. Governments, therefore, intervene to provide, fund and regulate these social services to address market failures. Expenditure by the government will target the expansion of infrastructure, the training and employment of more teachers and the provision of learning materials, thereby improving pupils' quality and learning experience (Musah and Aawaar, 2022). Despite government interventions in Sub-Saharan Africa (SSA), the region still has the worst educational statistics compared to the rest of the world (Musah and Aawaar, 2022; UNESCO Institute for Statistics, 2023). Education exclusion rates are astronomically high in SSA than other world regions. Over 20% of children aged 6–11 are currently not enrolled in schools, and the percentage increases to over 33% for youth aged 12– 14, according to data from the UNESCO Institute for Statistics (2023). Nearly 60% of young people aged 15–17 are not attending school, as reported by the UNESCO Institute for Statistics (2023). Average class sizes in SSA, from primary to tertiary levels, are the highest, limiting the quality of interaction between teachers and students in SSA schools (Musah *et al.*, 2024; Musah and Aawaar, 2022). These numbers are scary and could be due to either low levels of educational investments or ineffective and inefficient use of educational investments in the region. Therefore, there is a need to improve the return on the meagre educational investments in SSA.

In particular, the effectiveness of public spending in improving educational outcomes and quality may be significantly hampered by low-quality institutions. Poor institutional quality can derail the benefits of government social intervention expenditures. Governments may spend on education, but if the institutions are poor, that expenditure may not yield the desired results. Acemoglu and Verdier (2000) note that corruption is a natural by-product of public intervention in providing social services. Funds may be misapplied, bureaucracy may slow the application of funds to educational programmes, corruption may reduce the return on public financing of education and a lack of action to punish corrupt persons may encourage people to steal more. Public servants buy equipment and materials employed as ingredients in generating public goods (Haque and Kneller, 2015). They (public servants) may falsely advertise high-quality projects with higher costs at the contracting stage while delivering low-quality projects with lower costs owing to informational disparity (Van Bon, 2019; Haque and Kneller, 2015). Hence, even if corruption increases the amount of money utilised for investment in public projects, it decreases the returns on that money, in this case, because the projects either fail or are of poor quality (Van Bon, 2019). Therefore, the government can allocate significant educational resources without seeing positive results if corruption is pervasive. In the SSA context, the quality of institutions in the SSA region is the worst across all measures of institutional quality. The poor state of institutions could therefore be the reason for the low returns on educational investment in SSA.

Surprisingly, studies that analyse the impact of institutional quality on the effectiveness of educational investment in SSA are missing. Also, studies that investigate the relationship between public education financing and educational outcomes fail to analyse the moderating effect of the quality of institutions on the relationship. Existing studies, such as that of Van Bon (2019), analyse the role of institutional quality in the nexus between public spending and the growth of the economy. However, to our knowledge, no study has examined the moderating effect of institutional quality on the nexus between public education financing and educational quality, particularly in the context of SSA.

This study fills a niche in the literature by investigating the moderating role of institutional quality in the public education financing–educational quality nexus in SSA, the region with the worst educational statistics based on data from the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and the World Bank. Additionally, the study analyses the direct effects of institutional quality measures on

SSA's educational quality. This study contributes to the literature by arguing that public intervention's effectiveness in education depends on the quality of institutions. The findings of this paper contribute to improving the return on public education financing and educational quality in SSA. Two research questions are addressed in this paper:

RQ1. What is the effect of institutional quality on educational quality in SSA?

RQ2. What is the moderating role of institutional quality on the nexus between public education financing and educational quality in SSA?

We arrange the rest of the paper as follows: Section 2 reviews the literature, Section 3 outlines the methodology and data, Section 4 analyses and discusses the results and Section 5 concludes and provides policy recommendations.

2. Literature review
2.1 Overview of education and institutional quality in Sub-Saharan Africa
Across all regions, SSA has the lowest educational achievements and the most challenging task of supplying schools with the essential basic resources (UNESCO Institute for Statistics, 2023). Despite efforts, the region's educational prospects remain poor. For example, the exclusion rate is scary, with more than 20% of children aged 6–11, 33% of children aged 12–14, and at least 50% of teens aged 14–17 not attending school (World Bank, 2020). In SSA, around six million boys and nine million girls will never attend school (UNESCO Institute for Statistics, 2023). In comparison to the rest of the world, class sizes in SSA are huge, reflecting poor educational quality. In SSA, the number of students per teacher in primary school is 37, compared to the global standard of 23; in secondary schools, the number of students per teacher is 22, compared to the global average of 17 (World Bank, 2020; Musah and Aawaar, 2022). As a result, the fundamental problem for SSA governments is to find ways to expand educational opportunities, enhance quality and increase equity while coping with inadequate and insufficient financial resources (UNESCO Institute for Statistics, 2011).

Education is predominantly supplied by the public sector in many SSA nations, particularly at the lower levels and hence, accounts for a significant portion of government spending (UNESCO Institute for Statistics, 2011). In the current economic climate, governments must make tough choices regarding mobilising and distributing resources, particularly considering the increased demand for other public services such as infrastructure and healthcare. When examining education finance, the first point to consider is how much and what resources are available for educational growth. The most used metric for this issue is public education spending as a proportion of overall government spending and gross domestic product (GDP). Typically, the government provides funds to the education sector based on the needs of the country and the priority assigned to education.

The return on investments in education in SSA is among the lowest globally (Fomba *et al.*, 2023; Rodrik *et al.*, 2004). Incidentally, many SSA countries have faced governance challenges, including corruption, political instability and weak rule of law (World Bank, 2020) over the years. These challenges can hinder economic development and social progress. Rodrik *et al.* (2004) note that in SSA, the effectiveness of public investments is weakened by poor governance. Institutional quality could therefore play a role in the effectiveness of public education spending in SSA.

2.2 Theoretical literature
Human capital theory remains the main channel through which public education financing affects educational attainment. The human capital theory postulates that government

spending on people will improve their educational attainment and economic well-being (Becker, 1964).

Theoretically, institutional quality can impact the effectiveness of public expenditure in several ways. Firstly, suppose institutions are weak and corruption is rampant. In that case, wealthy population groups can influence governments to direct social expenditures towards providing educational programmes that better serve their interests (Dridi, 2014). Secondly, budgetary allocations to education spending may be affected in countries where institutional quality is poor. The government's ability to raise sufficient tax revenue is significantly lower in countries where institutions are poor; hence, the amount of resources available for investments in social services will be low (Dridi, 2014). Thirdly, poor institutional quality could also permit the diversion of public funds allocated for education into private pockets. Government workers who are responsible for procuring goods and services for education may submit high-return, high-cost proposals and deliver low-return, low-cost projects (Haque and Kneller, 2015). According to Dridi (2014), institutional quality (corruption) may negatively impact the amount and efficacy of international aid for education. International education aid has been crucial in supporting national programmes in many developing nations that strive to enhance access, ensure equity and improve the quality of education. However, deploying aid flows effectively in countries with poor institutions (high levels of corruption) would be more challenging because a significant portion of foreign assistance meant for education is frequently diverted from its intended uses (Dridi, 2014). The donor community would undoubtedly be reluctant to provide any additional aid due to the ineffectiveness of the aid, which would limit external assistance and lower the available resources for investment in education.

2.3 Empirical literature
Empirical studies on the effect of measures of institutional quality on education are few and primarily rely on one dimension of institutional quality: corruption. While several studies find a positive effect of institutional quality on educational outcomes (Fomba *et al.*, 2023; Ejuvbekpokpo and Hassan, 2019; Dridi, 2014; Nir and Kafle, 2013; Gupta *et al.*, 2001; Mo, 2000), other studies find no consistency in the findings and conclude that the outcome depends on the technique adopted (Dreher and Herzfeld, 2005; Pellegrini and Gerlagh, 2004).

Fomba *et al.* (2023) analyse the relationships between the quality of institutions and education in developing countries. Using data from 82 developing countries, they found that the quality of institutions improves educational outcomes in terms of completion and failure rates. Ejuvbekpokpo and Hassan (2019) make similar conclusions to those of Fomba *et al.* (2023), having examined the institutional quality–educational attainment nexus in low-income Sub-Saharan African countries. Dridi (2014) finds similar evidence on the nexus between the quality of institutions (corruption) and education. He finds that a one-unit increase in corruption reduces educational enrollment by 10%. Nir and Kafle (2013) find similar evidence by exploring the nexus between political stability and educational quality (measured as the survival rate). Their analysis shows that political stability plays a far more significant role in improving educational quality than even a country's per capita GDP. They conclude that political instability prevents pupils from enrolling in school, destroys school infrastructure, forces schools to close and causes significant population displacements. In a panel of 128 developed and developing nations, Gupta *et al.* (2001) examined the effect of corruption on the delivery of public education services. They discovered a positive and strong correlation between the extent of corruption and many metrics of educational progress, including expulsion rates, primary school failure rates and illiteracy rates. In a study of 46 countries from 1970 to 1985, analysing the impact of corruption on human capital, Mo (2000)

concludes that corruption reduces the average number of years of schooling. Mo (2000) finds that a one-unit increase in corruption reduces the average schooling years by 0.25 years.

Other studies, however, find results that are contrary to those mentioned earlier. Pellegrini and Gerlagh (2004) find that corruption does not significantly impact the average number of school years. Dreher and Herzfeld (2005), in a cross-sectional study involving 71 countries from 1975 to 2001, find corruption to show no consistency in its significance in predicting human capital (education and health). They further conclude that the effect of corruption on education is sensitive to the estimation technique employed.

Empirical evidence on the moderating role of institutional quality on the nexus between public education financing and educational quality, especially in the SSA context, is scanty and almost nonexistent. A few studies analyse the interaction effect of institutional quality measures and public expenditure on economic development indicators (Nguyen et al., 2018). To the best of our knowledge, none of the recent and most cited papers on the education financing–education quality nexus analyses the moderating role of institutional quality in the nexus.

3. Data and methodology
3.1 Variables and data
The study uses data for the period 2002–2020 obtained mainly from the World Development Indicators (WDI) and the World Governance Indicators (WGI) of the World Bank, covering 46 Sub-Saharan African countries. The inclusion of countries and the selection of the study period are based purely on the availability of data on the study variables.

3.1.1 Dependent variables. As a metric for evaluating educational quality, we use the student–teacher ratio. According to empirical data, the quality of education tends to decline as the number of pupils per instructor rise (Fomba et al., 2023). As Angrist and Lavy (1999) and Case and Deaton (1999) point out, higher class sizes restrict student–teacher engagements and do not encourage customised student supervision or monitoring. As a result, the instructor cannot follow up with each student individually and offer personalised answers to their unique difficulties. Therefore, the ratio of pupils to teachers is frequently used to compare the standard of education between nations (United Nations Economic Commission for Africa - UNECA, 2019). While examining the relationship between public education financing/financial sector development and educational quality, the pupil–teacher ratio has been used as a quality of education indicator in other studies (Musah et al., 2024; Musah and Aawaar, 2022).

3.1.2 Independent variables. The leading independent variables of the study were public education financing and institutional quality. In line with existing literature (Fomba et al., 2023; Musah and Aawaar, 2022), we adopt World Bank data on public education expenditure as a percentage of GDP as a measure of public education financing. In this study, we adopt the six components of the governance measures from the World Governance Indicators of the World Bank as measures of institutional quality (Kaufmann et al., 1999a, b, 2010). These variables include control of corruption, government effectiveness, regulatory quality, the rule of law, political stability, the absence of violence/extremism and voice and accountability. We then compute an index of institutional quality with these six dimensions using principal component analysis (PCA). The moderating role of each of these measures of institutional quality is estimated in separate regressions.

3.1.3 Control variables. This study uses remittances, GDP per capita and the under-five mortality rate as control variables. These variables were taken from research on the factors influencing educational outcomes, including those by Musah et al. (2024), Musah and Aawaar (2022), Tchamyou et al. (2019), Yogo (2017) and Shields and Menashy (2019). The under-five mortality rate is expected to have a negative coefficient. Income per capita and remittances positively impact the ratio of students to teachers.

Remittance inflows often reduce household financial strains and result in more school hours for kids. So, we anticipate that the remittance coefficient will be positive (Abdul-Mumuni and Koomson, 2019). When household income increases, the relative cost of enrolling children in school drops, implying that higher educational achievements could result from higher household income (Gupta *et al.*, 2002). The per capita GDP is used to represent household income levels. Health outcomes directly impact educational outcomes. Children who eat healthier foods have better overall health, which benefits their school performance, persistence and mental development (Glewwe and Jacoby, 1995). This study uses the under-five mortality rate as a stand-in for child nutrition, which aligns with Gupta *et al.* (2002). As a result, we anticipate that the under-five mortality rate will have a positive coefficient.

3.2 Empirical model and estimation technique
To analyse the effect of institutional quality and its moderating role in public education financing–educational quality nexus, we model educational quality as a function of public education financing, institutional quality, the interaction between public education financing and institutional quality and control variables in line with existing literature, as shown in Equation (1).

$$EQ_{it} = f(INSQ_{it}, PEF_{it}, Z_{it}) \tag{1}$$

Assuming linearity, we specify the educational quality model as follows (Equation 2):

$$E.Q._{it} = \partial_0 + \partial_1 E.Q._{it-1} + \partial_2 INSQ_{it} + \partial_3 PEF_{it} + \partial_5 \ln PCI_{it} + \partial_6 REM_{it} + \partial_7 UFMR_{it} + \varepsilon_{it} \tag{2}$$

To examine the moderating role of institutional quality, we include a term for the interaction between institutional quality measures and public education financing, as shown in Equation (3).

$$E.Q._{it} = \partial_0 + \partial_1 E.Q._{it-1} + \partial_2 INSQ_{it} + \partial_3 PEF_{it} + \partial_4 (PEF_{it} \times INSQ_{it}) + \partial_5 \ln PCI_{it}$$
$$+ \partial_6 REM_{it} + \partial_7 UFMR_{it} + \varepsilon_{it} \tag{3}$$

We estimate Equation (3) using the two-step system generalised method of moments (GMM) of Blundell and Bond (1998) due to the dynamic nature of educational outcomes. The GMM does well at addressing endogeneity, heterogeneity and autocorrelation issues (Ajide and Ojeyinka, 2022). The GMM is especially suitable when there are more cross-sections (46 countries) than periods (19 years) in the panel. There are gaps in our panel, although strongly balanced. So, to maximise the number of observations, we estimate using orthogonal deviations.

The Arellano and Bond tests for first- and second-order serial correlation in the error terms AR (1) and AR (2), respectively, and the Hansen test for overidentification are used to assess the validity and reliability of the instruments.

4. Results and discussion
This section presents the empirical results on the moderating role of institutional quality measures on the nexus between public education financing and educational quality in Sub-Saharan African countries.

4.1 Summary statistics

Table 1 (in the online appendix) presents the summary statistics for the study variables and the data source for each variable. According to Table 1 (in the online appendix), the primary school pupil–teacher ratio is 41.469, which means there are about 41 children per teacher throughout the SSA nations studied. The pupil–teacher ratio of 41 is substantially more than the worldwide average of 23.6 children per teacher in primary school (World Bank, 2020), indicating SSA's poor educational quality. The averages for secondary and tertiary levels are 25.19 and 21.059, peaking at 80.052 and 147.56, respectively, both above the world averages for the relevant levels (please see Table 1 in the online appendix). The worldwide average for secondary schools is 18 students per teacher (World Bank, 2020), which is lower than the SSA average of 25.19.

Public education financing averages 4.001% with a standard deviation of 1.947%. In a few countries, it is less than 1%. This level of government funding is grossly inadequate, given the poor state of education in SSA (please see Table 1 in the online appendix). Patel and Annapoorna (2019) noted that education in less developed countries (LDCs) is a public good and therefore, public education spending need enhancement. Most Sub-Saharan African countries are less developed, emphasising the need to improve public spending on education. Indeed, development organisations such as UNESCO and UNDP regard the ideal annual public education expenditure as 6% of GDP. Only a few SSA countries can meet and sustain this.

Based on the results in Table 1 (in the online appendix) and consistent with prior studies (Fomba *et al.*, 2023), institutional quality in SSA is as poor as the quality of education in the sub-region. Table 1 (in the online appendix) shows that no single measure of institutional quality records a positive mean value. The standard deviations for each mean value of all six (6) institutional quality indicators are less than one (1) in absolute terms, showing that the countries are similar in terms of institutional quality. Most of the countries in SSA record negative values, showing poor performance in terms of the quality of institutions. Only a few countries record positive values across the indicators of institutional quality.

4.2 Correlations

This section presents the correlation matrix of the explanatory variables of the study to check for possible multicollinearity among the variables. We present the results in Table 2 in the online appendix.

Each of public education financing (PEF), GDP per capita (lnPCI), remittances (REM) and under-five mortality rate (UFMR) records lower correlations with other explanatory variables (please see Table 2 in the online appendix). They do not, therefore, pose multicollinearity issues. However, the results show high correlations among the institutional quality measures. Loading these highly correlated variables into a single model will create multicollinearity problems. Therefore, this study estimates separate regressions for each measure of institutional quality for each level of education. Therefore, seven separate regressions are estimated for each measure of educational outcome.

4.3 Stationarity test

This study employed the traditional Im *et al.* (2003) unit root test to determine the stationarity of the series used in this study. It considers individual effects, time trends and common time effects. The IPS test presupposes that all series are non-stationary under the null hypothesis. We present the results in Table 3 in the online appendix.

The results in Table 3 (in the online appendix) show that none of the study variables are integrated in the second order. Nine (9) of the series are stationary at levels, while the remaining five (5) are stationary at the first difference. All institutional quality measures,

remittances and the under-five mortality rate are stationary at levels. Table 3 (in the online appendix) further shows that public education financing, per capita income (log) and all three dependent variables (primary pupil–teacher ratio, secondary pupil–teacher ratio and tertiary pupil–teacher ratio) are stationary at first difference.

4.4 Empirical results

This section discusses the moderating role of institutional quality on the nexus between educational quality and public education financing at the primary, secondary and tertiary levels of education in SSA. The results are discussed in Sections 4.4.1, 4.4.2 and 4.4.3 for primary, secondary and tertiary schools.

4.4.1 Moderating effect of institutional quality on public education financing–primary education quality nexus. Table 1 presents the results on the role of measures of institutional quality in the nexus between public education financing and the quality of primary education.

Table 1 shows that public education financing negatively and significantly affects the pupil–teacher ratio in primary schools. This finding indicates that increasing government expenditure on education reduces the pupil–teacher ratio in primary schools, thereby improving the quality of primary education in SSA. Studies such as Gupta *et al.* (2001) and, more recently, Musah and Aawaar (2022) as well as Fomba *et al.* (2023) find similar results.

Table 1 further shows that some institutional quality measures are not significant in explaining changes in the pupil–teacher ratio in primary schools. The broad-based institutional quality index (Model 1 of Table 1), government effectiveness (Model 3 of Table 1), rule of law (Model 6 of Table 1), regulatory quality (Model 5 of Table 1) and voice and accountability (Model 7 of Table 1) all show no significant effects on educational quality (pupil–teacher ratio) in primary schools at the conventional 5% level of significance. Only two measures of institutional quality record significant negative values, indicating that improvements in corruption control and a stable political environment improve the quality of education in SSA. As presented in Models 2 and 3 of Table 1, respectively, control of corruption and political stability significantly negatively affect the quality of primary education.

However, the interactions of nearly all measures of institutional quality with public education financing are negative and significant at the conventional 5% significance level. For instance, the interaction of broad-based institutional quality with public education financing presented in Model 1 of Table 1 is negative and significant at the conventional 5% significance level. This finding shows that broad-based institutional quality moderates the nexus between the pupil–teacher ratio in primary schools and public education financing. The interaction between public education financing and broad-based institutional quality significantly improves primary school education quality. In other words, public education financing is more effective in improving primary education quality in the presence of quality institutions. The interaction of control of corruption with public education financing also records a negative and significant effect on the quality of primary education (pupil–teacher ratio in primary schools), as shown in Column 2 of Table 1. This result shows that implementing robust measures to curb corruption will enhance the effectiveness of public education financing in increasing the quality of primary education in SSA. Column 3, Column 4 and Column 6 in Table 1 further show that government effectiveness, political stability and the rule of law all interact favourably with public education financing to reduce the pupil–teacher ratio in primary schools, improving the quality of primary education. This finding means that effective governance, a stable political environment and strict adherence to the rule of law improve the effectiveness of public education investment in improving the quality of education in SSA. Table 1 also shows in Columns 5 and 7 that regulatory quality, voice and

Variables	(1) Index	(2) CC	(3) GE	(4) PV	(5) RQ	(6) RL	(7) VA
Pupil–teacher ratio – primary (lag)	1.283***	1.245***	1.283***	1.219***	1.183***	1.245***	1.149***
	(0.11)	(0.104)	(0.11)	(0.105)	(0.098)	(0.105)	(0.099)
Public education finance	0.155*	-0.372**	-0.312*	-0.213*	-0.047	-0.333**	-0.112
	(0.082)	(0.162)	(0.183)	(0.107)	(0.153)	(0.152)	(0.121)
Institutional quality	0.634	-2.399**	1.05	-2.429**	0.309	2.091*	1.372
	(0.674)	(0.986)	(1.115)	(0.966)	(1.164)	(1.101)	(0.818)
Public education financing × Institutional quality	-0.378**	-0.824***	-0.626**	-0.654**	-0.132	-0.737***	-0.323*
	(0.156)	(0.264)	(0.258)	(0.246)	(0.254)	(0.264)	(0.173)
Per capita income (log)	3.031***	2.555**	3.031***	2.034**	1.623**	2.503**	1.243
	(1.098)	(1.027)	(1.098)	(0.985)	(0.908)	(1.001)	(0.831)
Remittances	0.146**	0.214**	0.146**	0.152**	0.113*	0.184**	0.117*
	(0.069)	(0.079)	(0.069)	(0.07)	(0.061)	(0.071)	(0.068)
Under-five mortality	-0.033***	-0.027***	-0.033***	-0.021***	-0.022**	-0.027***	-0.018**
	(0.01)	(0.009)	(0.01)	(0.007)	(0.009)	(0.008)	(0.008)
Constant	-34.119**	-28.055**	-33.335**	-23.442**	-19.421*	-27.771**	-14.844
	(12.586)	(11.708)	(12.755)	(11.495)	(10.71)	(11.547)	(9.891)
Diagnostics							
Observations	317	317	317	317	317	317	317
Instruments	22	22	22	22	22	22	22
Countries	37	37	37	37	37	37	37
AR (1)	0.003	0.003	0.003	0.002	0.003	0.003	0.002
AR (2)	0.799	0.790	0.799	0.838	0.762	0.752	0.779
Hansen	0.812	0.712	0.812	0.626	0.644	0.721	0.582

Note(s): Standard errors are in parentheses, ***$p < 0.01$, **$p < 0.05$ and *$p < 0.1$; Index = institutional quality index, CC = control of corruption, GE = government effectiveness, PV = political stability, RQ = regulatory quality, RL = rule of law and VA = voice and accountability
Source(s): Authors' own computations

Table 1.
Quality of primary education, public education financing and institutional quality

accountability do not significantly moderate the nexus between public education financing and the quality of primary education (pupil–teacher ratio in primary schools).

Remittances, per capita income and under-five mortality all recorded significant coefficients. Under-five mortality records a negative coefficient, indicating that reducing child mortality increases the pupil–teacher ratio. This finding shows that measures to curb child mortality must be accompanied by measures to enhance teacher recruitment and training.

4.4.2 Moderating effect of institutional quality on public education financing–secondary education quality nexus. This section discusses results on the role of institutional quality measures in the nexus between public education financing and secondary education quality. The results of seven models representing separate estimations for the seven measures of institutional quality are presented in Table 2.

The results in Table 2 show that public education financing has a direct positive and significant effect on the pupil–teacher ratio at the secondary school level, similar to the findings of Musah *et al.* (2024) and Musah and Aawaar (2022) for secondary schools but contrary to the findings of Fomba *et al.* (2023), Duerrenberger and Warning (2018) and Gupta *et al.* (2001). This finding shows that increasing government financing of education increases the pupil–teacher ratio at the secondary level, thereby reducing the quality of education at the secondary level in SSA. These findings are consistent with the researchers' expectations, as enrolments remain challenging in SSA secondary schools. Thus, public spending on secondary education in SSA is targeted at enrolment with little attention paid to quality.

Table 2 shows that all institutional quality measures are highly significant in explaining changes in the pupil–teacher ratio in secondary schools. They all recorded significant positive coefficients. Broad-based institutional quality index (Column 1 of Table 2), control of corruption (Column 2 of Table 2), government effectiveness (Column 3 of Table 2), political stability (Column 4 of Table 2), regulatory quality (column 5 of Table 2), rule of law (column 6 of Table 2) and voice and accountability (Column 7 of Table 2) all show highly significant positive effects on the pupil–teacher ratio in secondary school at the conventional 5% level of significance. The results indicate that improvement in institutional quality measures increases the pupil–teacher ratio, thereby reducing the quality of interaction between teachers and pupils in secondary schools. These findings are contrary to the findings on primary education.

Contrary to the direct effects of the institutional quality measures, the interactions of all measures of institutional quality with public education financing are negative and significant at the conventional 5% significance level. For instance, the interaction of broad-based institutional quality with public education financing presented in Column 1 of Table 2 is negative and significant at the conventional 5% significance level. It shows that broad-based institutional quality significantly moderates the nexus between the pupil–teacher ratio in secondary schools and public education financing. The interaction between public education financing and broad-based institutional quality significantly improves secondary school education quality. In other words, public education financing is more effective at improving secondary education quality when institutions are of high quality. Fomba *et al.* (2023) find similar outcomes in their study. The results in Column 2 of Table 2 show that the interaction of corruption control with public education financing also negatively and significantly affects the quality of secondary education (pupil–teacher ratio in secondary schools). This finding suggests that tightening the loopholes by stopping or reducing corrupt activities will help improve the effectiveness of public education financing by increasing the quality of education in Sub-Saharan African secondary schools. Similar to broad-based institutional quality and control of corruption, government effectiveness (Column 3 of Table 2), political stability (Column 4 of Table 2), regulatory quality (Column 5 of Table 2), rule of law (Column 6 of Table 2) and voice and accountability (Column 7 of Table 2) all interact favourably with

Variable	(1) Index	(2) CC	(3) GE	(4) PV	(5) RQ	(6) RL	(7) VA
Pupil–teacher ratio – secondary (lag)	0.966***	0.949***	0.966***	0.935***	0.948***	0.968***	0.996***
	(0.069)	(0.085)	(0.069)	(0.084)	(0.082)	(0.087)	(0.072)
Public educ. finance	0.066	0.277**	0.243***	-0.069	0.23*	0.177*	-0.136
	(0.065)	(0.111)	(0.062)	(0.099)	(0.126)	(0.095)	(0.11)
Institutional quality	1.237***	3.121***	2.048***	1.35***	2.12***	1.554***	1.1**
	(0.277)	(0.449)	(0.458)	(0.313)	(0.49)	(0.385)	(0.48)
Public education financing × Institutional quality	-0.25***	-0.576***	-0.414***	-0.263***	-0.456***	-0.318***	-0.239**
	(0.044)	(0.096)	(0.074)	(0.054)	(0.112)	(0.074)	(0.093)
Per capita income (log)	-0.283	-0.381	-0.283	-0.397	-0.314	-0.226	-0.086
	(0.371)	(0.35)	(0.371)	(0.306)	(0.399)	(0.378)	(0.299)
Remittances	0.000	0.019	0.000	-0.006	-0.01	0.009	0.019
	(0.018)	(0.03)	(0.018)	(0.027)	(0.028)	(0.028)	(0.027)
Under-five mortality	0.012***	0.017***	0.012***	0.011***	0.01***	0.011***	0.008***
	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Constant	1.875	4.384	3.404	4.306	4.061	2.562	0.724
	(4.219)	(4.38)	(4.459)	(3.877)	(4.826)	(4.747)	(3.702)
Diagnostics							
Observations	183	183	183	183	183	183	183
Instrument	22	22	22	22	22	22	22
Countries	34	34	34	34	34	34	34
AR (1)	0.014	0.019	0.014	0.016	0.018	0.017	0.016
AR (2)	0.465	0.478	0.465	0.435	0.446	0.460	0.462
Hansen	0.460	0.477	0.460	0.511	0.450	0.493	0.491

Note(s): Standard errors are in parentheses, ***$p < 0.01$, **$p < 0.05$ and *$p < 0.1$; Index = institutional quality index, CC = control of corruption, GE = government effectiveness, PV = political stability, RQ = regulatory quality, RL = rule of law and VA = voice and accountability
Source(s): Authors' own computations

Table 2.
Quality of secondary education, public education financing and institutional quality

public education financing to reduce the pupil–teacher ratio in secondary schools, leading to improvement in the quality of secondary education. It means that effective governance, a stable political environment, improved quality of regulatory institutions, strict adherence to the rule of law and enhanced accountability all improve the effectiveness of public education investment in improving the quality of secondary education in SSA, similar to the findings on primary education.

Contrary to the findings on primary education, remittances and per capita income recorded no significant coefficients, showing that they do not significantly impact the quality of education in secondary schools. Under-five mortality records a positive coefficient, indicating that reducing child mortality decreases the pupil–teacher ratio in secondary schools.

4.4.3 Moderating effect of institutional quality on public education financing and tertiary education quality. This section discusses results on the role of institutional quality measures in the nexus between public education financing and the quality of tertiary education in SSA. The results of seven models representing separate estimations for the seven measures of institutional quality are presented in Table 3.

The results in Table 3 show that public education financing has a direct negative and significant effect on the pupil–teacher ratio in Sub-Saharan tertiary schools, similar to primary education findings but contrary to secondary education findings. This finding shows that increasing government financing of education reduces the pupil–teacher ratio at the tertiary level, thereby improving the quality of education at the tertiary level in SSA.

Table 3 shows that all institutional quality measures, except political stability, record negative and highly significant coefficients on the pupil–teacher ratio in tertiary schools in SSA. They all recorded significant negative coefficients. Broad-based institutional quality index (Column 1 of Table 3), control of corruption (Column 2 of Table 3), government effectiveness (Column 3 of Table 3), regulatory quality (Column 5 of Table 3), rule of law (Column 6 of Table 3) and voice and accountability (Column 7 of Table 3) all show highly significant negative effects on pupil–teacher ratio in tertiary schools at the conventional 5% level of significance. The results indicate that improvements in institutional quality measures decrease the pupil–teacher ratio in tertiary schools, improving the quality of interaction between teachers and pupils. These findings are contrary to those in secondary schools.

In Table 3, we observe that, unlike the direct effects of the institutional quality measures, the coefficients of the interactions of public education financing with most (4 out of 7) of the measures of institutional quality are insignificant, at the conventional 5% level of significance, in explaining changes in the pupil–teacher ratio in tertiary schools. The coefficients for the interaction of public education financing with corruption control (Column 2 of Table 3), political stability (Column 4 of Table 3), rule of law (Column 6 of Table 3) and voice and accountability (Column 7 of Table 3) are all not significant at the conventional 5% level of significance. The coefficients of the interaction of public education financing with three of the measures of institutional quality are, however, significant at the 5% level. For instance, the coefficient of the interaction of broad-based institutional quality with public education financing presented in Column 1 of Table 3 is negative and significant at the conventional 5% significance level. It shows that broad-based institutional quality significantly moderates the nexus between the pupil–teacher ratio in tertiary schools and public education financing. The interaction between public education financing and broad-based institutional quality significantly improves the quality of education in tertiary schools. In other words, public education financing is more effective at improving tertiary education quality when institutions are of high quality. Similarly, the coefficients of the interactions of public education financing with government effectiveness (Column 3 of Table 3) and regulatory quality (Column 5 of Table 3) are negative and significant at 5%. These findings

Variables	(1) Index	(2) CC	(3) GE	(4) PV	(5) RQ	(6) RL	(7) VA
Pupil–teacher ratio – tertiary (lag)	0.636***	0.58***	0.636***	0.686***	0.704***	0.619***	0.599***
	(0.049)	(0.046)	(0.049)	(0.067)	(0.047)	(0.048)	(0.071)
Public education finance	-0.739***	-0.283**	-0.289***	-0.569***	-0.078	-0.306**	-0.382***
	(0.116)	(0.128)	(0.103)	(0.173)	(0.17)	(0.138)	(0.068)
Institutional quality	-1.962***	-4.666***	-3.247***	0.183	-4.038***	-4.166**	-4.355***
	(0.569)	(1.614)	(0.942)	(0.739)	(1.012)	(1.802)	(1.447)
Public education financing × Institutional quality	-0.364**	0.501	-0.603**	-0.034	-0.969***	0.532	0.555*
	(0.151)	(0.369)	(0.249)	(0.216)	(0.261)	(0.383)	(0.312)
Per capita income (log)	-0.496	-0.169	-0.496	-0.557	-0.788**	-0.443	-0.123
	(0.47)	(0.516)	(0.47)	(0.576)	(0.364)	(0.438)	(0.54)
Remittances	0.021	0.05	0.021	0.007	0.032	0.032	0.039
	(0.038)	(0.031)	(0.038)	(0.041)	(0.033)	(0.032)	(0.039)
Under-five mortality	-0.007	-0.026	-0.007	0.001	-0.01	-0.018	-0.006
	(0.013)	(0.015)	(0.013)	(0.013)	(0.013)	(0.016)	(0.014)
Constant	14.7***	11.387**	12.276***	13.072***	13.068***	12.427***	10.357**
	(3.975)	(4.548)	(3.763)	(3.889)	(2.783)	(3.748)	(4.287)
Diagnostics							
Observations	128	128	128	128	128	128	128
Instruments	22	22	22	22	22	22	22
Countries	30	30	30	30	30	30	30
AR (1)	0.029	0.036	0.029	0.029	0.030	0.031	0.033
AR (2)	0.344	0.311	0.344	0.298	0.332	0.298	0.302
Hansen	0.248	0.341	0.248	0.259	0.266	0.289	0.226

Note(s): Standard errors are in parentheses, ***$p < 0.01$, **$p < 0.05$ and *$p < 0.1$; Index = institutional quality index, CC = control of corruption, GE = government effectiveness, PV = political stability, RQ = regulatory quality, RL = rule of law and VA = voice and accountability
Source(s): Authors' own computations

Table 3.
Quality of tertiary education, public education financing and institutional quality

show that effective governance and enhanced quality of regulatory institutions lead to improvements in the quality of education in Sub-Saharan African tertiary schools.

Contrary to the findings on primary and secondary education, remittances and under-five mortality have no significant coefficients across all seven models presented in Table 3, showing that they do not significantly impact the quality of education in tertiary schools. The income per capita records a significant negative coefficient in only one (Column 4) of the seven models for tertiary schools.

5. Conclusions and recommendations

This study analyses the effect of institutional quality and the moderating role of institutional quality on the nexus between public education financing and educational quality in SSA. The study employs the two-step SGMM to analyse the dynamic relationships between the dependent and independent variables. This paper uses data on Sub-Saharan African countries to estimate the study variables' relationships.

First and foremost, consistent with our expectations, increased public education financing increases educational quality in primary and tertiary schools but reduces quality in secondary schools in Sub-Saharan African countries. It signifies that public education spending on secondary schools is targeted at increasing enrolment and next to little is done about improving the conditions that guarantee the quality of education (Musah *et al.*, 2024). Investments in infrastructure and teacher recruitment and training do not move in tandem with enrolment (UNESCO Institute for Statistics, 2011). Similarly, Mish (2020) noted that most of the public financing of secondary education goes into fee subsidies. Therefore, public investment in primary and tertiary education must be increased to improve the quality of education in SSA. Policymakers must also direct public education spending on secondary schools to teacher recruitment and training and infrastructural development in order to improve quality.

The study further finds that institutional quality improvements significantly improve educational quality at SSA's primary and tertiary levels. Improvements in control of corruption, political stability, bureaucracy quality and overall institutional quality all improve educational quality in Sub-Saharan African primary schools, suggesting that educational quality suffers in countries where institutions are poor. In tertiary schools, however, improvements in all the institutional quality measures except political stability enhance the quality of education.

The findings also show that institutional quality moderates the nexus between public education financing and educational quality at all levels of education. The interaction of public education financing and institutional quality improves primary, secondary and tertiary educational quality. This means that the return on public education financing is more effective in countries with strong institutions.

Based on the study findings, this paper makes two key recommendations. First, SSA governments must channel more resources into education in order to improve the quality of education. In doing so, governments must make sure that funds dedicated to secondary schools are invested into teacher recruitment and training as well as infrastructural expansion to cope with growing numbers at the secondary level. Second, the study recommends that SSA governments make efforts to improve the quality of institutions in the sub-region in order to improve the return on the educational investments.

The current study has a few limitations. The study fails to analyse the impact of COVID-19 on the findings of this study. Future studies could therefore explore the various ways in which COVID-19 could impact the findings of this study. Again, the findings of this study cannot be extended to other forms of education, such as technical and vocational education and training. We therefore recommend that future studies analyse the role of institutional quality in the nexus between public spending and the quality of technical and vocational education and training (TVET) programmes.

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Appendix
The supplementary material for this article can be found online.

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