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Assessing the Impact of Official Development Assistance on Primary School Performance in Côte d'Ivoire: An Econometric Analysis

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Despite the benefits of education, the learning crisis in the developing world has led the World Bank to characterize it as learning poverty. Education is yet to be declared a political priority in most developing countries. Official Development Assistance (ODA), which is a mechanism for financial support from governments and their agencies to developing countries and territories, for primary education could improve education quality. This study investigates the relationship between ODA to primary education, political stability, teacher-pupil ratio, government education expenditure, and primary school performance in Côte d'Ivoire. The study uses data from the World Development Indicators and World Governance Indicators databases for the years 2002-2021. The time series characteristics of the data were ascertained and the long-run dynamics among the variables were investigated. The findings suggest that ODA has a significant negative long-run impact on primary school performance. Teacher-pupil ratio and changes in political stability also have a negative impact. Government education expenditure has an insignificant impact. However, in the short-run, teacher-pupil ratio and Government education expenditure have negative and significant impact on primary school performance. The study highlights the need for efficient aid allocation, optimal teacher deployment, and stable policy environments to enhance primary education performance.

Keywords: Official development assistance, primary education, Côte d'Ivoire, ARDL model, education outcomes

JEL: O11, O15, I22

The learning crisis in developing countries has reached critical levels, with 53% of children unable to read a simple text by age 10 (World Bank, 2022a). Despite political rhetoric, education remains underprioritized, and resource limitations plague primary education systems. ODA is often sought to supplement budget allocations, but its impact on education quality remains unclear (Niyonkuru, 2016). Education quality falls under the theory of the Education production function which posits that several factors (inputs) affect education performance (output) (Babcock and Betts, 2009; Coleman, 1966; Hanushek, 1986). Existing literature on the education production function has theoretical and practical gaps. Indeed, education outputs (quality) for instance could take on different meaning or definition. Theory does not suggest which definition should be used. However, to assess more fully progress in primary education, it is most useful to examine what proportion of children complete primary school (Glewwe and Muralidharan, 2016a). Thus, education quality goes beyond the simple idea of enrolment

rate to investigate the rate of completion. While enrolment rates indicate the number of children who are attending school, completion rates provide to some extent a more accurate picture of the effectiveness of the education system (UNESCO, 2022). When addressing theoretical issues in education quality, countries or region peculiarities are often overlooked. Different countries could have different education outputs with similar inputs. This underscores the need for caution in generalizing findings on the quality of education. Glewwe and Muralidharan (2016b) emphasize teacher quality, conditional cash transfers, and school infrastructure as critical factors to school performance. In addition, Hanushek and Woessmann (2015) highlight education quality, cognitive skills, and institutional frameworks as drivers of economic growth. The works of these scholars inform our study by emphasizing the significance of understanding education production functions and the potential benefits and impact of ODA in improving primary education through the provision of funding for teacher training, and educational materials among other things. Therefore, this study addresses these gaps by investigating the short and long-term dynamics of ODA's impact on primary school performance in Côte d'Ivoire. Thus, we seek answers to the following questions:

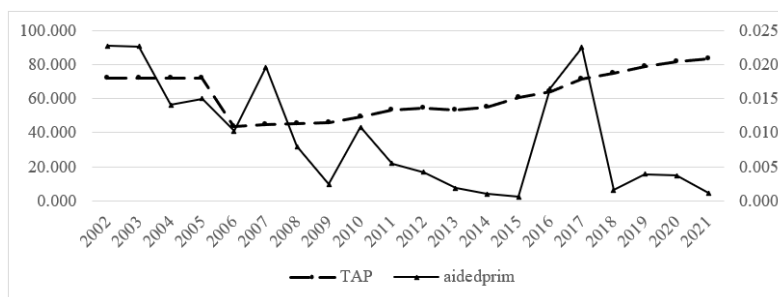
1. Does ODA allocated to primary education significantly impact changes in primary school performance in Côte d'Ivoire?
2. Are there short- and long-term dynamics in the relationship between ODA and changes in primary school performance?
3. Does changes in political stability influence changes in primary school performance in Côte d'Ivoire?

The next section presents the stylized facts on primary education in Côte d'Ivoire and ODA together with completion rate and a set of control variables. It is followed by a review of selected literature. The methods of analysis and data are examined in the methodology section. Remaining sections focus on the empirical findings, discussion of the results, policy implications, limitations and future research directions.

Stylized Facts

In Côte d'Ivoire, efforts are made to lift the rate of primary school achievement. Data gathered from international sources (World Bank, 2022b) showed that after falling to its lowest level in 2006, it has been on an upward sloping trend. It dropped from 72% in 2002 to 43.7 in 2006 representing 39.3% fall in a four-year period. It should be indicated that this period corresponded to the beginning of the social turmoil that the country experienced. Indeed, in September 2002, there was a failed military coup that

mutated into a rebellion (in the South) dividing the country into two separate zones. One under the control of the official government where there was a continuous functioning of the public administration and the other (in the North) under the control of the rebel forces. Thus, the school system was disrupted in the northern part of the country and could not be accounted for in the official education data.

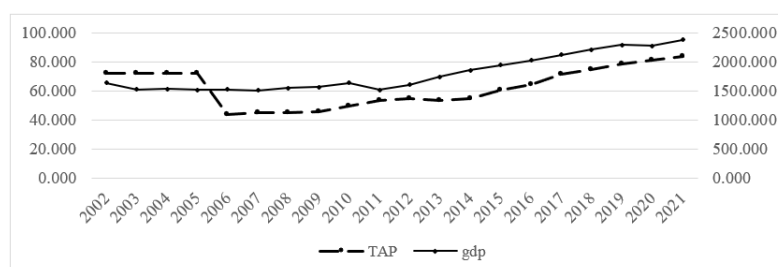


Source: World Development Indicators World Bank 2022

Figure 1. Trend of Primary School Achievement Rate and ODA to the Primary Education Sector in Cote d'Ivoire from 2002 to 2021

From 2006 going forward, we observed that school completion rate (TAP) had an almost smooth upward sloping trend. This is thanks to the peaceful resolution of the conflict and the reunification of the country. Unlike the TAP variable, ODA to primary education was mostly downward sloping with some spikes in the years 2007, 2010, 2016–2017.

When we compare the TAP variable and per capita Gross Domestic Product (GDP), it is observed that except for the years 2002 to 2006 (Figure 2) where a sharp drop of the TAP variable was registered, the two variables had an upward sloping trend.



Source: World Development Indicators World Bank 2022

Figure 2. Trend of Primary School Achievement Rate and GDP per Capita in Cote d'Ivoire from 2002 to 2021

The visual graphical analysis showed that these two variables could be moving together. But this needs to be confirmed empirically. We then compared the TAP variable against Government Education

Expenditures variable (Figure 3). It could be observed that Government education expenditures dropped in 2003 possibly due to the aftermath of the failed military coup that mutated in rebellion and then partitioned the country into North and South. Going forward, the trend of Government education expenditures was upward sloping although not smooth. Indeed, in 2011 another decline was observed. This could also be attributed to the post electoral crisis in the country that led to a civil war. It is therefore evident for Government education expenditures to fall. Another fall in Government education expenditures could be observed from 2019 to 2021. This fall could be attributed to the Covid-19 pandemic where the government had to redirect resources to address the more pressing health concerns.

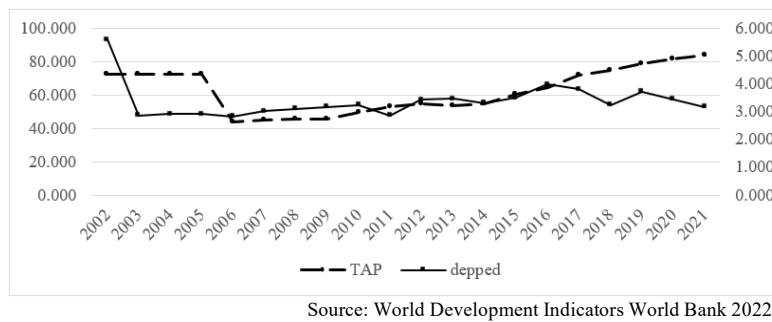


Figure 3. Trend of Primary School Achievement Rate and Government Education Expenditures in Cote d'Ivoire from 2002 to 2021

Figure 4 puts the trend of ODA to the primary education and government education expenditures side by side. We observe no systematic correlation between the two. However, it appears that in some instances where ODA is on the decline, there was an increase of Government education expenditures.

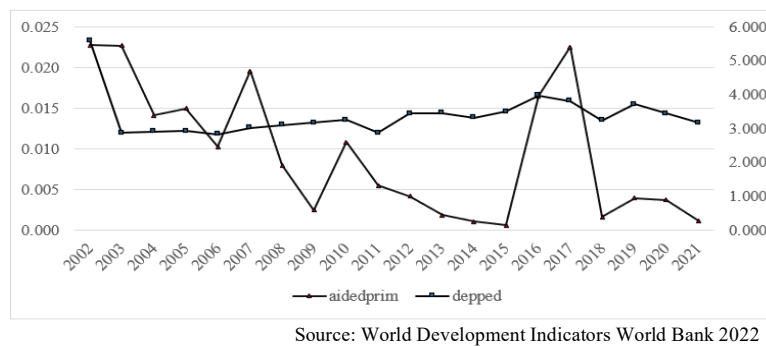


Figure 4. Trend of ODA to the Primary Education Sector and Government Education Expenditures in Cote d'Ivoire from 2002 to 2021

This was the case in 2006, 2008–2009, and 2011–2015. With the sharp increase in ODA in 2016 and 2017, a decrease in the Government education expenditures was observed in 2017 and 2018. Unfortunately, the reduction in 2018 coincided with a sharp drop in ODA. Going forward after 2018 ODA and Government education expenditures had similar trend.

LITERATURE REVIEW

Theoretical Underpinnings

This study anchors itself in the education production function theory, originating from the economic theory of production functions. This framework models the transformation of inputs into educational outputs, such as student achievement (Glewwe and Muralidharan, 2016b). They specified the education production output as a function of years of schooling, school and teacher characteristics, child characteristics, household characteristics and educational inputs (daily attendance and school supplies among others). Recent advancements in this theory highlight the complexity in capturing all the factors in the education production function.

Building on Becker's (1964) human capital theory, researchers have refined the concept of education production functions. Indeed, Becker's work introduced the rate of return on education, comparing benefits to costs (Becker, 2013). Subsequent studies expanded on this foundation.

Coleman's (1966) seminal work, "Equality of Educational Opportunity," examined the relationship between school inputs and student outcomes in the United States. Although not explicitly termed "education production function," Coleman's research guided future studies (e.g., Glewwe and Muralidharan, 2016b; Hanushek, 1986).

Hanushek's (1986, 2013) contributions emphasized the significance of teacher quality, school resources and institutional factors in determining student performance. His findings challenged the assumption that increased spending guarantees improved educational outcomes (Hanushek and Woessmann, 2015). In addition, other theoretical developments highlight contextual influences whereby institutional frameworks, governance and policy environments shape education production functions (North, 2013; Sen, 1993); Teacher's quality significantly impact student outcomes (Hanushek and Rivkin, 2012; Rockoff and Speroni, 2011); family and socioeconomic factors influence educational attainment (Haveman and Wolfe, 2015). To enhance the understanding of education production functions in the context of Côte d'Ivoire, this study also considers Amartya Sen's "Capability Approach" which focuses on access, equity and quality education (Sen, 1993), and Bandura's Social Cognitive Theory (Bandura, 2011) which examines teacher–student interactions, motivation and learning environments. Thus, our study brings and binds together elements of the above theories.

Empirical Review

Official Development Assistance and School Performance

The Education Production Function (EPF) theory considers financial resources as the key input because it supports the resources, teacher quality, infrastructure, and programs all that are of great importance for performance via optimal student learning outcomes. While the efficiency of spending is important, research by scholars such as Hanushek (2007), Krueger (1999), and Woessmann (2016) consistently demonstrates that adequate and well-targeted funding can lead to improvements in educational quality, equity, and student achievements. Therefore, considering funding as a vital input in the education production function is crucial for understanding how to enhance educational systems. A specific aspect of funding has to do with development aid which plays a pivotal role in the education production function, particularly in countries that lack the financial resources to invest adequately in their education systems. Research consistently shows that well-targeted ODA which is a mechanism for financial support from governments and their agencies to developing countries and territories can improve educational outcomes. Collier (2007), Dreher *et al.* (2006), and Michaelowa and Anke (2007) demonstrate ODA's positive impact on access, infrastructure, and education quality. Recent studies reinforce these findings: Yogo (2017) assessed the effectiveness of foreign Aid in the education sector in Africa focusing on primary education in a panel data setting with data ranging from 2000 to 2010 for 35 countries. He found that higher aid to education significantly increases primary completion rate in Africa.

Lim (2021) studied the association between foreign aid for education and educational outcomes in a panel data setting with data ranging from 1970 to 2013. The author showed that higher per capita education aid associates with increased enrollment and completion rate.

Musa *et al.* (2021) analyzed the impact of foreign aid on education and health outcomes in Nigeria using dynamic ordinary least squares in a vector autoregressive model setting with data ranging from 1980 to 2019. Their results revealed foreign aid's significant positive impact on primary school enrollment and completion rates in Nigeria. Similarly, Lekhak (2023) examined the relationship between education aid and different levels of schooling, specifically primary, secondary, and tertiary education. The author analyzed the impact of education aid on completion rates for females and males at the primary level. The study used data from a panel of 50 low and lower-middle-income countries spanning over the period ranging from 2002 to 2020 in a system Generalized Method of Moments (GMM) setting. The author found education aid to have a positive impact on primary education outcomes, specifically completion rates. The positive relationship was confirmed by Sangaré and N'Zué (2023) in their study of the impact of ODA on school performance within the West African Economic and Monetary Union (WAEMU). They used a panel ARDL model with data ranging from 2002 to 2021. Unlike the above

empirical studies, ODA may not always positively influence school performance. For instance, there are studies that showed mixed to no impact of ODA on primary school performance (Addis and Tura, 2018; Miyamoto and Chiofalo, 2020).

However, given the higher number of studies that found a positive influence of ODA on school performance, it can be inferred that by providing critical resources for building schools, training teachers, and reforming curricula, development aid could certainly enable countries to achieve better educational outcomes.

H₁: Official development assistant positively influences school performance.

Teacher-to-Pupils Ratio and School Performance

This ratio refers to the number of teachers available per student in a classroom. A lower teacher-to-pupil ratio means fewer students per teacher, which can lead to more personalized instruction, greater student engagement, and better learning outcomes. The teacher-to-pupil ratio is a key input in the education production function because it directly influences the quality of instruction, classroom management, and student engagement (Glewwe and Muralidharan, 2016a). By allowing teachers to provide more individualized attention and reducing their workload, lower teacher-to-pupil ratios create a more conducive learning environment. Several scholars have provided strong empirical evidence that reducing class size, and thus improving the teacher-to-pupil ratio, can lead to significant improvements in student outcomes. Card and Krueger (1992) linked lower teacher-to-pupil ratios to higher future earnings. They measured school quality by the pupil/teacher ratio and found that men who were educated in states with higher-quality schools have a higher return.

Krueger's (1999) work on the Tennessee STAR experiment in which students were given a set of standardized tests at the end of each school year for four years. Students were randomly assigned to different class sizes (small, regular, and regular/aide). They found that students in smaller classes performed better thus supporting the argument that a lower teacher-to-pupils ratio (small classes) can improve student outcomes. Ladd's (2002) research highlighted that pupil in smaller class sizes (mostly private schools) performed better than those in larger class sizes (mostly public schools). In his international comparisons of education systems, Woessmann (2003) studied various inputs to the education production function, including class size and teacher-to-pupil ratios. He found that while teacher quality and other factors play a significant role, reducing class size can enhance student outcomes. Chetty *et al.* (2011), in their research on long-term impacts of education inputs, using data from Project STAR (indicated earlier) found that students assigned to smaller classes in early grades were more likely to attend college. Their study demonstrated the long-term benefits of smaller classes.

Similar results were found by Kamwitha (2023) who studied the influence of pupil–teacher ratio in Early Childhood Education (ECE) on graduation rates in integrated Embu County public primary schools, Kenya. The author showed a positive correlation between pupil–teacher ratio and internal efficiency. Consequently, we can infer from the above that high teacher to pupil ratio (a proxy of education quality) negatively influences school performance.

H₂: Teacher–to–pupil ratio negatively influences school performance.

Political Stability and School Performance

Political stability as an element of governance is a key input in the education production function model (Bloom and Sachs, 1998; Collier and Hoeffler, 2004). Indeed, it affects various aspects of educational delivery, and can have disruptive effects on educational outcomes (Collier and Hoeffler, 2004). For instance, it allows to maintain consistent investments in education over the long–term and supports the establishment of effective policies, education budgets, and reform agendas without the disruption of governance changes or conflict. This long–term commitment is essential for building quality educational infrastructure, teacher recruitment, training, retention, and the consistent provision of educational materials. Thus, political stability ensures continuity in educational policies and investments. Several scholars have emphasized political stability in the education production function. For instance, Bénabou (1996) showed how political instability leads to short–termism in government policies and reduces long–term educational outcomes. In the same line, Alesina *et al.* (1996) showed the negative impact of political instability on economic growth and education. In addition, Bloom and Sachs (1998), in their research on global development, argued that political stability supports sustained educational improvements and showed how political instability in low–income countries often leads to the underfunding of social services, including education. Similarly, while analyzing the relationship between civil conflict and education, Collier and Hoeffler (2004) highlighted how political instability and conflict can disrupt educational systems. In the same vein, Davies (2007) argued that political stability enhances education outcomes. Countries with stable political environments are better able to invest in their education systems, provide equitable access, and improve long–term educational outcomes. Based on above instances, political stability is a key input in the education production function since it creates the conditions necessary for sustained investment, continuity of policies, and a safe learning environment. We therefore hypothesize that:

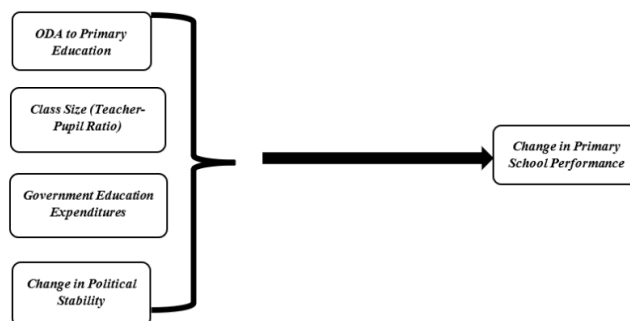
H₃: Political stability positively influences school performance.

Government Education Expenditures and School Performance

Research has consistently shown that government education expenditures significantly impact school performance. Indeed, in the education production function framework developed by Glewwe *et al.* (2020), schools and teachers characteristics play a key role. In developing countries, these key characteristics are function of government education expenditures. It is therefore critical to analyze the expected relationship between government education expenditures and school performance. It is in that line that González *et al.* (2018) analyzed the impact of public education spending on student outcomes in Latin America, and found a positive correlation between expenditures and test scores. Similarly, Borge and Naper (2019) investigated the relationship between government spending on education and student achievement in Organization for Economic Co-operation and Development (OECD) countries and confirmed a positive effect. Afolabi and Adejumo (2020) examined the impact of public education expenditure on primary school completion rates in Nigeria, revealing a significant positive relationship. In the same vein, Makinde and Afolabi (2022), and Shah and Khan (2022) found that increased government education expenditure improved student performance. All these studies underscore the critical role government education expenditures play in enhancing school performance. Despite the evidence presented above, some studies found that government education expenditure does not have a significant impact of primary school performance. These include Gupta *et al.* (2019), and Oketch and Rolleston (2007), who reported limited impact of increased education spending on school performance. In view of the evidence supporting the positive impact of government education expenditures, we propose the following hypothesis.

H₄: Government Education Expenditures positively influence school performance.

The conceptual framework of the study is drawn in Figure 5. In this framework, ODA to primary education (independent variable), together with other independent variables presented, cause changes in school performance.



Source: Author's presentation

Figure 5. Conceptual Framework

METHODOLOGY

Sample and Procedure

This study utilized time series data from the World Development Indicators (WDI) of the World Bank (2022b), spanning 2002–2021, with 20 observations. The dataset was supplemented with data from the Worldwide Governance Indicators database (Kaufmann *et al.*, 2024) for the political stability variable. The sample focuses on Côte d'Ivoire, providing insights into the relationships between ODA, school performance and selected independent variables. This relationship is modeled as a production function where changes in education completion rate taken as a proxy for changes in school performance is a function of ODA to primary education, class size, changes in political stability, growth rate, and changes in government education expenditures.

Variables	Definition	Measurement Methods	Data source
$Aidprim_t$	is the foreign aid allocated to the primary education sector	As a percentage of GDP	WDI
$dSchoolperf_t$	Change in the primary education completion rate	Completion rate is the percentage of children who successfully finish the last year of primary school. It's calculated by dividing the number of students who graduate by the number of children who are eligible to graduate	WDI
$dstabpol_t$	Change in the political stability index	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	WGI
$ratensel_t$	Teachers-to-pupils ratio	The ratio of teachers to pupils in a class	WDI
$dlndepped_t$	Change in Government education expenditures	As a percentage of GDP	WDI
$gdpggr_t$	GDP growth rate	Growth rate	WDI

Source: Author's presentation

Table 1. Variable Measurement

Model Specification

The education production function theory informs the model, examining the relationships between primary education completion rate (*Schoolperf*), ODA allocated to primary education (*Aidprim*) and the selected independent variables. The initial model is specified as:

$$Schoolperf_t = f(Aidprim_t, X_t) + \varepsilon_t \quad (1)$$

Where, *Schoolperf_t* represents the primary education completion rate, *Aidprim_t* is the foreign aid allocated to the primary education sector and *X_t* is a set of selected independent variables, and ε_t represents the

disturbance. The disturbance is assumed to follow a white noise process. The full regression equation with the variable of interest and the selected independent variables is presented below:

$$dlnSchoolperf_t = \alpha + \delta_2 lnaidprim_t + \delta_3 gdpgr_t + \delta_4 lnratensel_t + \delta_5 dstabpol_t + \delta_6 dlndepped_t + \varepsilon_t \quad (2)$$

Logarithm was used to transform the variables with the exception of growth rate of Gross Domestic Product (*gdpgr_t*) and changes in political stability (*dstabpol_t*) variables at time *t*. The reason being that growth rate can have negative values and the political stability variable ranges from −2.5 to 2.5. *lnaidprim_t* is the logarithm of ODA allocated to primary education sector at time *t*, *lnratensel_t* is the logarithm of the teacher-to-pupil ratio at time *t*, and *dlndepped_t* is Government education expenditures at time *t*.

Unit Root Test

I used the Augmented Dickey–Fuller (ADF), the Philip–Perron (PP), and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root tests to assess the stationarity of the variables considered for this study. This step is necessary to prevent the problem of spurious regression in subsequent analysis.

Autoregressive Distributed Lag (ARDL) Approach

Following the unit root test results, whether variables were stationary *I*(0) or integrated of order 1 (*I*(1)), we proceeded to investigate the short- and long-term relationships between ODA and primary education completion rate, using an Autoregressive Distributed Lag (ARDL) approach. Thus, equation (2) was reconfigured to capture both the short and long-run dynamics. The ARDL model provides a suitable framework for achieving this objective. The generalized ARDL(*p,q*) model is given below:

$$Y_t = \alpha + \sum_{i=1}^p \delta_i Y_{t-i} + \sum_{i=0}^q \beta'_i X_{t-i} + \varepsilon_{jt} \quad (3)$$

Where *Y_t* is the endogenous variable, *X_t* represents the explanatory variables and are all allowed to be *I*(0) or *I*(1); *α* is the constant, *δ* and *β* are parameters to be estimated; *p* and *q* are optimal lag orders. All the variables except *p* political stability and GDP growth rate were transformed into logarithm.

Bounds Testing

The ARDL approach involves Bounds testing (Pesaran *et al.*, 2001) to determine cointegration. The null hypothesis (*H*₀) assumes no long-run equilibrium relationship. We used the Akaike Information Criterion (AIC) to determine the number lags.

Conditional Error Correction Model (ECM)

With the lag length determined we get the unrestricted Error Correction Model that Pesaran (2004) called

conditional ECM or put differently, conditional ARDL (p, q) presented below:

$$\begin{aligned} \Delta \ln Schoolperf_t = & \alpha + \delta_1 \ln Schoolperf_{t-1} + \delta_2 \ln aidprim_{t-1} + \delta_3 gdpgr_{t-1} + \delta_4 \ln ratensel_{t-1} + \\ & \delta_5 dstabpol_{t-1} + \delta_6 dlndepped_{t-1} + \sum_{i=0}^q \beta_{1i} \Delta \ln Schoolperf_{t-i} + \sum_{i=0}^q \beta_{2i} \Delta \ln aidprim_{t-i} + \sum_{i=0}^q \beta_{3i} \Delta gdpgr_{t-i} + \\ & \sum_{i=0}^q \beta_{4i} \Delta \ln ratensel_{t-i} + \sum_{i=0}^q \beta_{5i} \Delta dstabpol_{t-i} + \sum_{i=0}^q \beta_{6i} \Delta dlndepped_{t-i} + \varepsilon_t \end{aligned} \quad (4)$$

The Bounds test is equivalent to testing the following hypotheses for the above equation:

$$\begin{cases} H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0 \\ H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq 0 \end{cases} \quad (5)$$

Estimation and Diagnostics

All computations were performed using Stata 17. Model diagnostics ensure serial independence of error terms and dynamic stability. Breusch–Godfrey Lagrange Multiplier test for autocorrelation and White’s test for heteroskedasticity were conducted. For model stability, we looked into the cumulative sum of squared error (CUSUMSQ).

RESULTS

This section presents the findings from the empirical analysis, focusing on the relationships between ODA to primary education, government education expenditures, political stability, teacher-to-pupils ratio, growth rate, and school performance.

Descriptive Statistics

The descriptive statistics of the variables of interest are presented in Table 2. The dependent variable i.e. school performance (*Schoolperf*) which is captured through the primary school completion rate had a mean of 62.42% over the period of analysis. The lowest completion rate stood at 43.74% in 2006 whereas the highest completion rate was registered in 2021 and it stood at 83.61%. When we considered the ODA allocated to primary education, it is observed that it stood on average at 0.009% of GDP. Its lowest level stood at 0.001% in 2015 while its highest level stood at 0.023% in 2002. Government education expenditures stood on average at 3.378% of GDP with a minimum of 2.82% (in 2006) and a maximum of 5.591% (2002).

Pairwise Correlation

Table 3 provides a pairwise correlation between the variables of interest. It could be observed that school performance (*schoolperf*) is positively correlated with ODA to primary education. However, that correlation is weak and not significant. Similarly, school performance is also positively correlated with political

stability, yet it is weak and not significant. It is observed that school performance is positively correlated with government education expenditures (*depped*) however it is also not significant. School performance

Variables	Obs.	Mean	S.D	Min	Max
<i>Schoolperf_t</i>	20	62.426	13.330	43.740	83.611
<i>aidprim_t</i>	20	0.009	0.008	0.001	0.023
<i>stabpol_t</i>	20	-1.400	0.456	-2.260	-0.833
<i>gdpgpr_t</i>	20	1.574	4.399	-7.314	8.499
<i>ratensel_t</i>	20	41.742	2.981	37.625	48.846
<i>depped</i>	20	3.378	0.614	2.820	5.591

Source: Author's computation

Table 2. Descriptive Statistics

is negatively and significantly correlated with the ratio of teachers to pupils (*ratensel*). Correlation coefficient measures degrees of linear association and may not necessarily portray the cause-effect relationship between variables. It is therefore important to proceed with other methods of analysis to unveil the causal effects if any.

	<i>schoolperf_t</i>	<i>aidprim_t</i>	<i>stabpol_t</i>	<i>gdpgpr_t</i>	<i>depped_t</i>
<i>schoolperf_t</i>					
<i>aidprim_t</i>	0.099				
<i>stabpol_t</i>	0.209	-0.584**			
<i>gdpgpr_t</i>	-0.137	-0.466	0.546*		
<i>depped_t</i>	0.280	0.286	0.153	0.007	
<i>ratensel_t</i>	-0.609**	0.122	-0.084	-0.259	0.035
Mean VIF	1.92				

Source: Author's calculation using STATA

VIF is the Variance Inflation Factor. It should be less than 5.

* $p < .05$; ** $p < .01$

Table 3. Correlation Matrix

Time Series Characteristics

Three tests were conducted i.e., Augmented Dickey Fuller (ADF), Philip Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS). Decisions were made based on the results confirmed with the KPSS test (Table 4). All the variables were $I(0)$ with the exception of ODA and teachers-to-pupils ratio variables which were $I(1)$.

Cointegration Tests

The Bounds test was used (Table 5) to determine cointegration. Two specifications were considered just

Variable	ADF		Philip Perron		KPSS		Decision
	Level	1 st Diff.	Level	1 st Diff.	Level	1 st Diff.	
<i>dlnschoolperf_t</i>	-3.767 [†]		-3.775 [†]		0.060 ^{**}		I(0)
<i>lnaidprim_t</i>	-2.444	-4.736 [†]	-2.286	-5.051 [†]	0.104	0.040 ^{**}	I(1)
<i>dstabpol_t</i>	-5.486 [†]		-5.600 [†]		0.063 ^{**}		I(0)
<i>gdpgr_t</i>	-3.396 ^{**}		-3.355 ^{**}		0.138		I(0)
<i>dlndeppe_t</i>	-9.077 [†]		-13.021 [†]		0.128 ^{**}		I(0)
<i>lnratensel_t</i>	-2.591 [*]	-5.015 [†]	-2.596	-5.419 [†]	0.198	0.040 ^{**}	I(1)

Source: Author's calculation using STATA

[†] $p < .10$ ^{*} $p < .05$; ^{**} $p < .01$ **Table 4. Unit Root Tests**

to assess the robustness of the results. The first specification was the full model with all the variables selected. Using the AIC we settled for an ARDL (1,0,1,1,0,1) and ARDL (1,0,1,0,1).

Specification		ARDL (1,0,1,1,0,1)		ARDL (1,0,1,0,1)	
F-statistics for H ₀		5.090		6.796	
Critical Values at 5%, F-statistic, Case 3 and K = 5				K = 4	
I(0)]	I(1)]	[2.62	3.79]	[2.86	4.01]

Source: Author's presentation

H₀ stands for no levels relationship or no cointegration relationship. Accept H₀ if $f < \text{critical value for } I(0) \text{ regressors}$.Reject H₀ if $F > \text{critical value for } I(1) \text{ regressors}$; Lag order is based on Akaike information Criteria (AIC)**Table 5. Cointegration Analysis using Bounds Test**

It resulted from the cointegration tests that regardless of the specification considered, the variables were cointegrated indicating the existence of long-run dynamics among the variables.

ARDL Model Analysis

Table 6 presented the results of the estimated models. The ARDL (1,0,1,0,1) model satisfies post-estimation diagnostics and is considered the better specification.

Long-Run Dynamics

–Aid to Primary Education (*lnaidprim*): The coefficient (−0.059) suggests that a 1% increase in ODA to primary education decreases changes in primary school performance by approximately 0.06%. This effect is only statistically significant at the 10% ($p\text{-value} = 0.063$). The empirical result partially supported the hypothesis that ODA to primary education influences changes in primary school performance, however, the direction of the relationship is opposite.

	ARDL (1,0,1,1,0,1)	ARDL (1,0,1,0,1)
	Coefficient	Coefficient
<i>ECT</i>	-0.836**	-0.884**
Long Run Dynamics		
<i>Lnaidprim</i>	-0.067	-0.059†
<i>Gdpgr</i>	-0.002	
<i>Lnratensel</i>	0.784	-0.859†
<i>Dstabpol</i>	-0.541*	-0.510*
<i>Dlndepped</i>	0.223	-0.011
Short Run Dynamics		
<i>D1. Gdpgr</i>	-0.007	
<i>D1. lnratensel</i>	-1.457**	-1.500**
<i>D1. dlndepped</i>	-0.262	-0.326*
<i>Cons</i>	-2.707	-3.077†
Adj R-sqrt	0.789	0.777
Breusch–Godfrey LM Test for Autocorrelation		
chi2(1)	6.634*	2.034
White's Test for Heteroskedasticity		
chi2(18)	18.000	18.000
Skewness	8.140	5.89
Kurtosis	0.320	0.000

Source: Author's calculation using STATA

† $p < .10$ * $p < .05$; ** $p < .01$; Dependent variable: *dlnschoolperf***Table 6. Results of the Estimated ARDL(p,q) Models**

–Teacher–Pupil Ratio (*lnratensel*): A 1% increase in the teacher–pupil ratio decreases primary school performance by approximately 0.86%. This is also significant only at the 10% probability level (p -value = 0.094). This result is also partially supportive of the hypothesis that teacher–to–pupil ratio negatively influences primary school performance.

–Political Stability (*dstabpol*): The coefficient (–0.510) suggests that a unit increase in the change in political stability decrease changes in primary school performance by approximately 0.51% (p -value = 0.011). Let's recall that the political stability index ranges from –2.5 to 2.5. For Côte d'Ivoire, this index has always been negative over the period of analysis. Thus, an improvement of this index is tantamount to an increase in the value of the index moving closer to positive number. The empirical result could be thought as counterintuitive. However, it is a stable political environment that could have a positive bearing on school performance. But a political environment that is always changing may not be conducive to improved school performance. Indeed, political instability (frequent change in government) could lead to education reform which will not necessarily yield the expected outcome (improved primary school performance). For instance, results of the “CONFEMEN Education System Analysis Programme” 2014

(PASEC144) and 2019 assessments (PASEC19) showed that despite reforms implemented after PASEC14, primary school performance did not improve in Côte d'Ivoire five years later (PASEC, 2020). The more reforms were implemented (with change in government) the worse the quality of the primary school performance became (The result does not support the initial hypothesis but it captures well the state of the quality of the primary education system in Côte d'Ivoire).

–Government Education Expenditure (*Indepped*): Here, the coefficient (-0.011) is insignificant ($p\text{-value} = 0.976$), indicating that Government education expenditures have no long-run impact on the changes in primary school performance. This result is also not supportive of the hypothesis that Government Education Expenditures positively influence changes in primary school performance.

Short-Run Dynamics

With respect to Teacher-Pupil Ratio (*DI.lnratensel*), the coefficient (-1.500) indicates that a 1% increase in the teacher-pupil ratio decreases the change in primary school performance by approximately 1.5% in the short run ($p\text{-value} = 0.005$). This result is supportive of the hypothesis that teacher-to-pupil ratio negatively influences primary school performance.

Similar result is found for Government Education Expenditure (*DI.lndepped*). The coefficient (-0.326) indicates that a 1% increase in the change of government education expenditure decreases the change in primary school performance by approximately 0.33% in the short-run ($p\text{-value} = 0.033$). Unlike the long-run result which was not significant, in the short-run although the result is not supportive of the hypothesis that Government Education Expenditures positively influence changes in primary school performance, but it is statistically significant.

Error Correction Model (ECM)

The ECM coefficient (-0.884) indicates that approximately 88.4% of the disequilibrium of the change in primary school performance is corrected in the next period.

Diagnostic Tests

For post-estimation diagnostic tests, we considered several tests i.e. Breusch-Godfrey Lagrange Multiplier (LM) test, the White's test for heteroskedasticity, the CUSUMSQ graph for stability test, and the Skweness and Kurtosis tests for Normality. The Breusch-Godfrey LM test showed No autocorrelation ($p\text{-value} = 0.153$). Similarly, the White's test for heteroskedasticity failed to reject the null hypothesis of homoskedasticity ($p\text{-value} = 0.389$).

The CUSUMSQ graph, as shown in Figure 6, appears stable, with no significant breaks or divergences from the straight line. This suggests that there is no structural breaks which implies that the model's

parameters remain relatively constant over time. Moreover, the squared residuals do not exhibit significant patterns or trends.

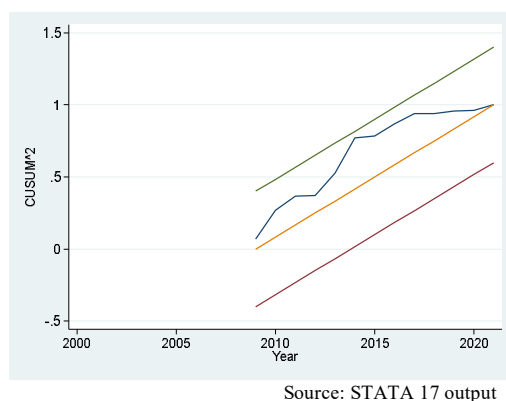


Figure 6. CUSUMSQ Graph

The Skewness ($p\text{-value} = 0.552$) and Kurtosis ($p\text{-value} = 0.996$) tests for normality failed to reject the null hypothesis of normality. The ARDL (1,0,1,0,1) model is therefore suitable for analyzing the relationship between ODA to primary education, government education expenditure, and changes in primary school performance. The model's coefficients (reported earlier) can consequently be relied upon for inference.

DISCUSSION

The empirical findings from this study align with and contribute to the existing literature on the impact of Official Development Assistance (ODA), teacher-to-pupil ratio, political stability, and government education expenditure on primary school performance.

In the long-run, the results indicate that ODA to primary education has a negative and significant impact on changes in primary school performance ($p\text{-value} < 0.10$), suggesting that aid may not be effectively targeted or utilized. This finding is consistent with Addis and Tura (2018), who reported mixed effects of ODA on education outcomes in Sub-Saharan Africa. It is also in line with Miyamoto and Chiofalo (2020) findings of limited impact of ODA on primary education completion rates. The reason this result could be that ODA is not effectively targeted or utilized in the country because of corruption or insufficient capacity. However, this study's negative coefficient contrasts with Glewwe and Maïga's (2011) findings of positive effects of ODA on primary education enrollment rates.

On Teacher-Pupil Ratio, the long-run results also show significant negative impact ($p\text{-value} < 0.10$) on primary school performance supports findings by Hanushek *et al.* (2013), who emphasized the

importance of optimal teacher deployment and UNESCO (2019), which highlighted the need for adequate teacher–pupil ratios. In addition, the findings confirmed studies by Card and Krueger (1992), Krueger (1999), Ladd (2002), Woessmann (2003), Chetty *et al.* (2011), and Kamwitha (2023). A high ratio of teachers to pupils indicates an inadequacy of qualified teachers in the education system. When there are not enough teachers to cater to the educational needs of all students, it can lead to overcrowded classrooms and limited individual attention, resulting in a lower quality of education. This could impact students' ability to learn effectively and complete their primary education successfully. In addition, when there is a high ratio of teachers to pupils, teachers may have excessive workloads, with larger class sizes and more students to manage. This can lead to increased stress, burnout, and reduced motivation among teachers. Fatigued and overwhelmed teachers may find it challenging to provide the necessary support and personalized attention required for students to thrive academically.

On changes in political Stability, its significant ($p\text{-value} < 0.05$) negative relationship with changes in primary school performance aligns with Alesina *et al.* (1996), who demonstrated the negative impact of political instability on economic growth and education and Davies (2007), who found that political stability enhances education outcomes. A politically stable environment allows schools to remain open and operate consistently. Students could attend school regularly without disruptions, conflict, or closures. Political stability enables governments to prioritize investments in education, including primary education with a greater likelihood that sufficient budgetary allocations would direct towards the sector thereby improving school infrastructure, availing learning materials, and ensuring teacher recruitment and training, which could positively impact changes in primary education completion rates.

On Government Education Expenditure, the insignificant impact of government education expenditure on primary school performance resonates with Gupta *et al.* (2019) on the inefficient allocation of education resources, and Oketch and Rolleston (2007) on the limited impact of increased education spending. This may result from ineffective or inefficient targeting of education expenditures.

In the short–run, results reveal intriguing insights into the relationships between the variables. Indeed, on teacher–pupil ratio, the coefficient (-1.500) is negative and significant ($p\text{-value} = 0.005$), indicating that an increase in the teacher–pupil ratio harms primary school performance in the short term. This finding aligns with UNESCO's (2019) emphasis on optimal teacher deployment for quality education. On Government education expenditures, interestingly, the result (-0.362) exhibits a negative and significant impact on changes in primary school performance ($p\text{-value} = 0.033$). This result resonates with Oketch and Rolleston's (2007) findings on the inefficiency of education expenditure in Africa. These findings highlight the complexity of education development and the need for nuanced policy approaches.

CONCLUSION

This study examined the impact of Official Development Assistance (ODA) to primary education, teacher-to-pupil ratio, political stability, and government education expenditure on changes in primary school performance in Côte d'Ivoire. The findings confirm that the research objective has been fulfilled, providing valuable insights into the complex relationships between these variables. The results suggest that in the long-run, 1) ODA to primary education has a negative and significant impact on changes in primary school performance in Côte d'Ivoire. 2) Teacher-pupil ratio shows significant negative impact on changes in primary school performance. 3) Changes in political stability negatively impacts changes in primary school performance. Lastly, 4) Government education expenditure has an insignificant impact on changes in primary school performance.

In the short-run, Teacher-pupil ratio, has a negative and significant impact on changes in primary school performance. Government education expenditures also have a negative and significant impact on changes in primary school performance.

In light of the above, this study contributes to the literature on aid effectiveness and education development, highlighting the importance of considering the nuances of aid allocation and utilization. The findings support the notion that education outcomes are influenced by a complex interplay of factors, including policy stability and resource allocation. The results have significant implications for policymakers, and donors i.e., 1) Efficient aid allocation and utilization strategies should prioritize teacher deployment and policy stability. 2) Governments should focus on optimizing resource allocation and improving education sector planning. 3) Donors should align funding with recipient countries' education priorities and support capacity-building initiatives. Our findings consequently underscore the need for efficient aid allocation, optimal teacher deployment, and stable policy environments to enhance primary education outcomes.

RECOMMENDATIONS

In line with the findings, the following recommendations to Policy Makers are in order: 1) There is the need to ensure that ODA is targeted, efficient, and aligned with recipient countries' education priorities; 2) The country should implement policies that promote optimal class size; and 3) the country should endeavor to maintain a stable policy environment that is conducive to education.

To Donors, we would recommend that they should 1) support capacity-building initiatives for effective aid management, and 2) prioritize education sector funding with clear performance metrics.

IMPLICATIONS

The study's findings have significant implications i.e., theoretical, managerial, and policy. In terms of

theoretical implications, our study strongly supports that the education production function incorporate development aid, government education expenditures, and political stability (policy environment), and teacher-to-pupil ratio (school resources) as key inputs that have a bearing on educational outcomes. Although the policy environment is already among the inputs, it is not usually disaggregated to account for development aid, government education expenditures, and political stability. In the same vein, teacher-to-pupil ratio should be considered when specifying the education production function.

In terms of management implications, there is the need to develop the capacity of all stakeholders involved in the education system to ensure the efficient management of resources including ODA.

Regarding policy implications our findings emphasize the need to ensure the optimization of teacher deployment for an optimal teacher-to-pupil ratio to improve primary school performance. Countries are encouraged to maintaining a stable policy environment, allocating education resources efficiently to maximize impact, and developing stakeholders' capacity for effective aid management and utilization. In addition, Donors and International Organizations, should prioritize education sector funding with clear performance metrics and support capacity-building initiatives for effective aid management.

LIMITATIONS AND FUTURE DIRECTIONS

The limitations of this study include 1) data availability constraints (20 observations), 2) possibility of omitted variable issues, and 3) focus on primary education only. With the limited data range, only limited number of possible explanatory variables could be included in the education production function. By addressing these limitations and implementing the recommended policies, Côte d'Ivoire can optimize ODA and government education expenditure to improve primary school performance.

Going forward, we would like to 1) investigate the impact of ODA in different education sub-sectors i.e., the secondary education sector and tertiary education sector, 2) analyze the relationship between education expenditure and economic growth, and 3) have a broader geographic scope by utilizing a panel of countries. Moreover, we shall consider incorporating variables that were not included in our current analysis—such as corruption perception, trade openness, institutional quality etc.

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