Does Financial Development Increase Education Level? 
Empirical Evidence from Sub-Saharan Africa

Mamadou Asngar Thierry¹ · Ongo Nkoa Bruno Emmanuel²

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Abstract
This study analyzes the effect of financial development on education in a sample of 37 sub-Saharan African countries with data covering the period from 2000 to 2018. We use the nine measures of financial development proposed by the International Monetary Fund (IMF) and the three levels of education, including primary, secondary, and tertiary education. Applying the two-stage system Generalized Method of Moment (GMM), we find that financial development increases school enrollment in each level in sub-Saharan Africa. The gender results also show that financial development improves primary and secondary education for both male and female, except at the tertiary level where the effect does not appear to be robust for male. Based on these results, we suggest that the financial market and financial institution in SSA should be improved given its beneficial effects on the education system.

Keywords  Financial development · Education · Sub-Saharan Africa · Gender

JEL Classification  A20 · A21 · A22 · A23 · E44 · G21

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Mamadou Asngar Thierry
tmamad07@yahoo.fr

Ongo Nkoa Bruno Emmanuel
ongoema@yahoo.fr

¹ Faculty of Economics and Management, University of Ndjamena, Ndjamena, Chad
² Faculty of Economics and Management, University of Dschang, Dschang, Cameroon
Introduction

For almost 2 years, the whole world has been going through the most difficult health crisis after the Second World War. The COVID-19 pandemic is creating significant dysfunctions in the social system in general and that of education in particular (UNESCO, 2020). Adaptation had to be made in order to avoid a lost school and academic year in many countries. More than ever, supporting education has never been so expensive. Low household financial participation could not effectively contribute to the additional expenditure of adaptation to new constraints (Tadros & Wootton, 2020). However, the work of Becker (1964), Schultz (1961), and Lucas (1988) shows that education is essential to the economic development of a country. According to Sivakumar and Sarvalingam (2010), education contributes to the reduction of income poverty. It is a factor of well-being acceleration (Becker, 1964). It contributes to knowledge assimilation and technological development (Williams et al., 2013). For Kuepié et al. (2009), education increases integration into the labor market and consequently reduces unemployment (Burdett & Smith, 2002). In behavioral economics, education increases the psychological stability of individuals and builds confidence for a better future (Ross & Bird, 1994).

In addition, education has taken a central place in the definition of sustainable development goals (SDGs). In recent years, the inclusion of financial development in the economic growth of countries has been well-documented. Indeed, according to Levine (2005), financial intermediaries, thanks to the five functions they play, stimulate economic growth through the accumulation of capital and factor productivity. These five functions cover the production of information on projects and resource allocation to the most profitable projects; monitoring of investments and control over company management; the facilitation of financial and commercial transactions; improving risk management; the mobilization of savings; and the facilitation of trade in goods and services. If banks are considered more advantageous nowadays, it is because they play an important role in financing sustainable development objectives (Park & Kim, 2020). Also, Galletta et al. (2020) supported that the banking industry has been considered to be a minor actor in the polluting sector. Their social and environmental responsibilities give them a major role to reduce environmental damages. By given credit in green activities, the financial sector controls the environmental degradation (Atsu et al., 2021). Financing the Sustainable Development Goals requires long-term financing which is mostly supported by the financial markets. The green assets implemented by companies contribute to the support of research. More specifically, banks give priority to SDGs on which their financing activities can make the biggest impact, as opposed to areas where their influence would come from their role as employers or purchasers of products or services. While all SDGs receive some attention, the SDGs that receive the greatest bank focus are those related to economic growth and decent work (SDG 8), climate action (SDG 13), clean energy (SDG 7), sustainable cities and communities (SDG 11), and responsible consumption and production (SDG 12).

Theoretically, Schumpeter (1911) argues that financial sector development plays a crucial role in long-term economic growth through the provision of quality financial
intermediation services. Empirically, it is increasingly becoming an axiom that the well-developed domestic financial sector is important for higher growth and education (Arora & Ratnasiri, 2011; Beck et al., 2000; Ibrahim & Alagidede, 2018; Levine, 1997, 2005; Levine et al., 2000).

The role of education in the economy had already been raised since the pioneering work of Smith (1776). From there, and from the point of view of the aggregate output of a country, it is possible to establish a direct link between education, accumulation of human capital, and development. It should be noted with human capital theorists that education is directly related to the accumulation of human capital. This would increase the productivity of this factor and will result to an increase in production and therefore in the wealth of the country in question (Romer, 1990; Mankiw et al., 1992).

It has also been argued that these effects are particularly strong in poor economies or in economies where income distribution is unequal (Galor & Zeira, 1993; Benabou, 2003). These studies suggest that financial backwardness may hamper the ability of agents to invest. This would be particularly true, but not only, for an agent’s human capital, as liquidity constraints can prevent an agent from investing in their own human capital at optimal levels. Accordingly, an interactive factor with GDP per worker and levels of financial development would be predicted as a negative determinant of the rates of accumulation of physical and human capital.

The relevance and adequacy of the education system were seen as one of the drivers of the quality of human capital. For example, Psacharopoulos (1986) provided one of the first works that studied the adequacy of the education system using a model that measures the cost of misallocation in the labor market arising from the education system. Topel (1997) distinguished between static and dynamic fit, the latter taking into account future demand in the labor market and the desired adjustment of the education system accordingly. Vincens (2005) focused on defining the qualitative and measurable adequacy of the education system, while Plassard and Tran (2009) identified over-education as a feature of inadequacy of the education system. As a result, over-education, or wasted resources, occurs when the number of years of schooling exceeds the education required to hold a given position.

A number of studies have examined how the financial knowledge and practices developed by students affect their future financial well-being (Chen & Volpe, 1998; Doll, 2000; Pilcher & Haines, 2000; Varcoe et al., 2001; Weston, 2001; Lyons & Anderson, 2002; Lyons, 2003; Lyons, 2004). These studies show that formal financial education plays an important role in reducing student financial management problems. Those who learn financial management skills at a younger age tend to fare better financially than those who do not receive financial education (Varcoe et al., 2001).

In recent decades, countries that have increasingly turned to the knowledge economy have become more competitive (Asongu, 2017; Chandra & Yokoyama, 2011; Chavula, 2010). In addition, these countries, becoming less attractive, have relied heavily on essential factors such as highly skilled labor, high-tech industries, and investment in new technologies, which are essential components for the development of a knowledge-based economy (AfDB, 2007). Besides investing in advanced technologies, the creation and dissemination of knowledge are also essential through
universities and research institutes. The knowledge economy can be understood as a political syndrome in Africa because, compared to other regions of the world, the continent’s overall knowledge index has been declining since 2000 (Anyanwu, 2012; Tchamyou, 2017).

However, Banerjee and Newman (1993) and Galor and Zeira (1993) conclude on a negative linear relationship between financial development and education. Their basic theoretical assumption is that financial market imperfections, such as financial asymmetries, transaction costs, and contract enforcement costs, can be particularly burdensome for households, which lack collateral, credit history, and network relationships. So even if the poor have high yield projects, they can be rationed by credit. This reduces the efficiency of capital allocation and limits the social mobility of the poor.

According to stylized facts, the number of pupils and students enrolled in African education systems, from primary to tertiary, including vocational education, has increased at an unprecedented rate. It went from 142.6 million learners in 1998 to 286.7 million in 2017 according to data from the UNESCO Institute for Statistics (2018). This expansion, a consequence of strong social demand, has fostered an institutional framework transformation, governance, teacher training offer, and teaching practices at all levels of education. In addition, other regional and global challenges, such as the objectives of the strategy for Africa (Agenda 2063), the continental education strategy 2016–2025, and the increase in the number of objectives and education indicators under the Sustainable Development Goal (SDG 4), put more emphasis on education systems in Africa and generate increased demand for education.

However, although it presents contrasting sub-regional situations in 2019, Africa remains poor in terms of school exclusion. With 21% exclusion, sub-Saharan Africa has a higher rate than North Africa (11%). Also, in sub-Saharan Africa, West African states often have the most alarming performance. The sub-region has a large proportion of illiterate young people (15–24 years). Although declining sharply, the percentage of out-of-school children remains a serious concern in West Africa. More than a quarter of children are excluded from primary school. For example, the most populous country in Africa, Nigeria, in 2010 had nearly 20% of the total out-of-school children in the world. The main cause for this situation is the lack of financial resources.

In the same vein, financial sectors have developed rapidly in most countries of Sub-Saharan Africa (SSA) since the early 1990s. However, they remain more limited compared to the rest of the world. In addition, banks in SSA remain dominant institutions that provide credit primarily to large corporations. Non-bank financial intermediaries, particularly the microfinance and insurance sectors, have also experienced rapid growth, but the size of these sectors relative to GDP and population remains small.

Statistics confirm that the role of financial intermediation played by banks in SSA is less important than in other countries, although there has been a catching-up since the 1990s. In 2020, the bank deposit/GDP ratios in middle-income countries (MICs) were on average around 43% in SSA, compared to 121% in Europe, while these ratios were 30% in low-income countries (LICs) of SSA and 34% in LICs in the
rest of the world (BEI, 2020). It should be noted that the level of depth differs considerably depending on the relative level of income of countries. On average, financial sectors are considerably deeper and more diversified in PRI ASSs than in LICs, where financial sectors are smaller and institutional coverage is more limited. The development of the financial sector is associated with an increased importance of bank deposits and therefore with a lower ratio between money in the strict sense and money in the broad sense. For example, in 2019, the broad money M2/GDP ratio stood at 47% and 32%, respectively, for PRI and PFRASS. Highlighting how difficult it is to achieve financial deepening, the M1/M2 ratio has barely changed since 2000 and in SSA, financial markets show a higher M1/M2 ratio (i.e., in other words, they are shallower) than that observed in other regions, which shows the difficulties these countries still face in moving towards means of payment other than cash.

This article analyzes the impact of financial development on education in Africa. There are very few studies that have focused on this subject by considering Africa as a sample. To our knowledge, no study has addressed this issue in Africa by considering the different aspects of financial development: depth, accessibility, and efficiency. The advantage with these nine indices is that they accurately reflect the measures of financial development in all their characteristics. In addition, several African countries are considered in the sample. Also, these indices are used more in recent studies (Ahad & Imran, 2021). Also, no study based on our knowledge has considered the same research paper the three levels of education, namely, primary education, secondary education, and tertiary education. Finally, very few studies have highlighted the role of financial development on education by emphasizing the gender aspect, by differentiating between boys’ and girls’ education. We take it into consideration for the robustness test. This article contributes greatly to the literature and fills this work gap. Much more, it allows over a recent period to appreciate the role of financial intermediation on education in Africa. Some studies have focused on external aid (Yogo, 2017), on the quality of institutions (Ouedraogo et al., 2021), and on foreign direct investments (Kaulihowa & Adjasi, 2019). But we focus on education which is an objective to attend Africa’s Agenda 2263.

By applying the Generalized Method of Moments (GMM) on a panel of 37 countries in sub-Saharan Africa, over the period 2000 to 2018, we find that financial development accelerates education in the region. Specifically, all three levels of education are positively influenced. This result remains robust when we add other explanatory variables or when we modify the financial development indicators.

This article proceeds as follows. In the “Methodology and Estimation Technique” section, we present the methodology used and the technical estimation. The “Variable’s Presentation and Data” section illustrates data and summarizes descriptive statistics. In the “Results and Discussion” section, we present and discuss the results by taking first baseline result and second robustness results. In the final section, we discuss the policy implications we drew from the empirical results.
Methodology and Estimation Technique

The model is inspired by the recent work of Nguyen et al. (2020) Nguyen and Su (2021) who highlighted the impact of financial development on economic complexity and export quality, respectively. The modified version of the model is specified as follows:

$$\text{Education}_{outcomes_{i,t}} = \alpha + \beta_1 \text{Education}_{outcomes_{i,t-1}} + \beta_2 \text{Financial}_{dev_{i,t}} + \beta_3 \text{X}_{i,t} + \epsilon_{it} \quad (1)$$

where, $\text{Education}_{outcomes_{i,t}}$ is captured by the primary, secondary, and tertiary enrollment rates, respectively, of country $i$ for year $t$. $\text{Financial}_{dev}$ denotes the various measures of financial development. The vector $X$ includes all the control variables, notably the logarithm of GDP per capita, oil revenues, official development assistance, and remittances. $\epsilon_{it}$ is the error term.

We apply the Generalized Method of Moment (GMM) initially proposed by Holtz-Eakin et al. (1988), then extended by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). There are several reasons for choosing this estimator. The first is that estimating the above equation with ordinary least squares (OLS) could lead to inefficient estimates, as OLS does not control for fixed effects and may suffer from variable omission bias. In addition, the presence of the lagged dependent variable in the model places our model in the context of a dynamic panel model. In the presence of a lagged dependent variable, Nickell (1981) argues that OLS and fixed effect estimators may be biased. Second, the estimator controls for a simultaneity bias caused by the possibility that some of the explanatory variables are endogenous. Third, it includes unobservable geographic and cultural factors such as climate and ethnic fractionalization.

In order to take advantage of panel data and to solve potential endogeneity problems, we resort to the Generalized Moment Method (GMM) whose First Difference Generalized Moment Method (FD-GMM) estimator was introduced by Arellano and Bond (1991) and Arellano and Bover (1995). Subsequently, Blundell and Bond (1998) improved the FD-GMM estimator by developing the System Generalized Moment Method-System (SGMM) estimator, which is more appropriate for solving endogeneity problems. The advantage of S-GMM modeling lies because it allows the endogeneity of the explanatory variables of interest and the other explanatory variables to be corrected. While S-GMM seems in theory more efficient than FD-GMM, it uses more instruments than the latter which makes it particularly inappropriate when the individual dimension is small. We use this method because we expect an endogenous relationship between explanatory variables and inequality measures. To solve this problem, instruments are introduced. We instrument the first differences of the explanatory variables by their values lagged by at least one period in level. As for their level values, we instrument them by the most recent first difference values. We perform the tests of model over-identification (Hansen test), error autocorrelation (AR1 and AR2), and the Windmeijer (2005) correction to validate the results of our specifications. We therefore specify the following GMM model:
We estimate Eq. (2) using a system GMM proposed by Blundell and Bond (1998) with robust standard errors corrected for finite samples using Windmeijer (2005) correction procedure. Roodman (2009) shows that the risk of “overfitting” the endogenous variable, which leads to biased parameter estimates, is maximal in a situation of instrument proliferation. To address these problems, following Roodman (2009), we limit the number of variables to be instrumented as well as the number of lags. As a result, the instruments for first-difference regression are lagged endogenous level explanatory variables (lags are considered from $t$ to 2), and the instruments for level regression are lagged endogenous difference explanatory variables (Uddin et al., 2017).

**Variable’s Presentation and Data**

We analyze the effect of financial development on primary, secondary, and tertiary education in a sample of 37 sub-Saharan African countries during the period 2000 to 2018. The study period and especially the sample size are chosen based on data availability. The data used come from two main sources, namely, the World Bank (2021) and the FDI-IMF (Financial Development Index database of IMF).

**Dependent Variable**

We use three dependent variables, including gross enrollment rates for primary, secondary, and tertiary education. The gross enrollment rate is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the showed level of education (World Bank, 2021). Primary education provides children with basic reading, writing, and mathematical skills, as well as a basic understanding of several subjects (World Bank, 2021). Secondary education complements the basic education begun at the primary level and aims to lay the foundation for lifelong learning and human development by providing more subject- or skill-based education with more specialized teachers. Higher education, whether or not it leads to an advanced research qualification, normally requires, as a minimum requirement for admission, the successful completion of secondary level education. In particular, the use of these indicators allows us to compare our results with recent studies by Ouedraogo (2021), Kaulihowa and Adjasi (2019), and Asongu and Tchamyou (2019) in Africa. Subsequently, we also distinguish each measure of education by gender. Thus, we analyze the effect of financial development on girls’

(2) $\text{Education\_outcomes}_{it} = \alpha + \beta_1 \text{Education\_outcomes}_{i,t-1} + \beta_2 \text{Financial\_dev}_{it} + \beta_3 \text{GDP\_per\_capita}_{it} + \beta_4 \text{Oil\_rent}_{it} + \beta_5 \text{Net\_OD\_received}_{it} + \beta_6 \text{Remittances}_{it} + \mu + \nu_t + \epsilon_{it}$
### Table 1  Descriptive statistics and data sources

| Variables                  | Obs | Mean   | Std. Dev | Min   | Max   | Sources          |
|----------------------------|-----|--------|----------|-------|-------|------------------|
| Primary school             | 629 | 99.646 | 22.072   | 32.356| 149.307| World Bank (2021) |
| Primary school (female)    | 628 | 95.829 | 24.168   | 25.985| 151.314| World Bank (2021) |
| Primary school (male)      | 628 | 103.485| 20.744   | 38.476| 150.998| World Bank (2021) |
| Secondary school           | 504 | 44.28  | 23.815   | 6.197 | 109.444| World Bank (2021) |
| Secondary school (female)  | 496 | 42.527 | 26.385   | 4.703 | 112.825| World Bank (2021) |
| Secondary school (male)    | 496 | 46.342 | 21.895   | 7.729 | 110.126| World Bank (2021) |
| Tertiary school            | 454 | 8.032  | 7.256    | 0.351 | 40.596| World Bank (2021) |
| Tertiary school (female)   | 419 | 7.387  | 8.612    | 0.171 | 47.457| World Bank (2021) |
| Tertiary school (male)     | 419 | 8.879  | 6.613    | 0.513 | 36.028| World Bank (2021) |
| Financial_Develop          | 665 | 0.147  | 0.107    | 0.028 | 0.648 | IMF (2020)       |
| Financial_institution      | 665 | 0.246  | 0.143    | 0.042 | 0.736 | IMF (2020)       |
| Financial_market           | 665 | 0.043  | 0.091    | 0     | 0.541 | IMF (2020)       |
| Financial_institution_depth| 665 | 0.124  | 0.184    | 0     | 0.883 | IMF (2020)       |
| Financial_institution_accessibility | 665 | 0.112  | 0.161    | 0.003 | 0.88  | IMF (2020)       |
| Financial_institution_efficiency | 665 | 0.528  | 0.149    | 0.117 | 0.848 | IMF (2020)       |
| Financial_market_depth     | 665 | 0.057  | 0.121    | 0     | 0.831 | IMF (2020)       |
| Financial_market_accessibility | 665 | 0.043  | 0.128    | 0     | 0.892 | IMF (2020)       |
| Financial_market_efficiency | 665 | 0.025  | 0.076    | 0     | 0.961 | IMF (2020)       |
| GDP per capita             | 695 | 1987.296| 2521.332| 194.873 | 14,417.055| World Bank (2021) |
| Oil rent                   | 695 | 2.586  | 8.118    | 0     | 56.269| World Bank (2021) |
| Net ODA received           | 694 | 8.319  | 7.775    | −0.251| 62.187| World Bank (2021) |
| Remittances                | 626 | 3.55   | 6.305    | 0     | 53.826| World Bank (2021) |
| Trade                      | 658 | 70.562 | 35.742   | 17.927| 225.023| World Bank (2021) |
| Education expenditure      | 451 | 17.279 | 5.235    | 5.03  | 37.521| World Bank (2021) |
| FDI                        | 695 | 4.204  | 6.079    | −4.846| 57.838| World Bank (2021) |

Source: author

Fig. 1  Relationship between financial development and primary and secondary education.  Source: author
primary and secondary education, on boys’ primary and secondary education, and also on girls’ and boys’ higher education.

**Independent Variable**

We use nine indices of financial development including overall financial development, financial institutions, financial institution depth, financial institution access, financial institution efficiency, financial markets, financial market depth, financial market access, and financial market efficiency that are collected from Financial Development Index of IMF (FDI-IMF) to proxy the financial development (FIN) (Svirydzenka, 2016). We generally agree with Levine (2005) on five main functions of the financial system: the mobilization and collection of savings; the production of information; facilitating transactions; diversification and risk management; and investment monitoring and evaluation. Based on this, the development of the financial system relies on three factors which are financial depth, accessibility, and efficiency. For Svirydzenka (2016), financial depth is the size of banks, other financial institutions, and financial markets in a country, taken as a whole, relative to a measure of economic output (GDP). For the World

| Variable names     | P-value and level | Decision |
|--------------------|-------------------|----------|
| Financial_Dev      | 0.0034            | I(0)     |
| Financial_inst     | 0.0010            | I(0)     |
| Financial_market   | 0.0068            | I(0)     |
| GDP per capita     | 0.0032            | I(0)     |
| Oil rent           | 0.0019            | I(0)     |
| Net ODA received   | 0.0000            | I(0)     |
| Remittances        | 0.0028            | I(0)     |

Source: Author
Table 3  Effects of financial development on education

|                          | Dependent var: primary school (1) | Secondary school (2) | (3) | (4) | (5) | (6) | Tertiary school (7) | (8) | (9) |
|--------------------------|-----------------------------------|----------------------|-----|-----|-----|-----|---------------------|-----|-----|
| L. dependent variable    | 0.893***                          | 0.803***             | 0.937*** | 0.890*** | 0.875*** | 0.983*** | 1.014*** | 1.017*** | 1.029*** |
| (0.0377)                 | (0.00723)                         | (0.0260)             | (0.0143) | (0.0121) | (0.00651) | (0.0112) | (0.0224) | (0.0207) |
| Financial_Dev            | 6.096***                          | 2.865**              | 2.865** | 1.914*** | 1.914*** | 1.914*** | 1.914*** | 1.914*** | 1.914*** |
| (2.097)                  | (1.323)                           | (0.452)              | (0.452) | (0.452) | (0.452) | (0.452) | (0.452) | (0.452) |
| Financial_inst           | 3.768***                          | 8.077***             | 8.077*** | 6.180*** | 6.180*** | 6.180*** | 6.180*** | 6.180*** | 6.180*** |
| (0.682)                  | (1.370)                           | (1.370)              | (1.370) | (1.370) | (1.370) | (1.370) | (1.370) | (1.370) |
| Financial_market         | 3.305***                          | 2.183***             | 2.183*** | 1.473*  | 1.473*  | 1.473*  | 1.473*  | 1.473*  | 1.473*  |
| (1.152)                  | (0.508)                           | (0.508)              | (0.508) | (0.508) | (0.508) | (0.508) | (0.508) | (0.508) |
| GDP per cap (ln)         | 0.437                             | 0.0753               | 0.140 | 1.674*** | 1.039*  | −0.0725 | 0.126*  | 0.0896  | 0.256*  |
| (0.449)                  | (0.172)                           | (0.190)              | (0.429) | (0.534) | (0.160) | (0.0749) | (0.290) | (0.143) |
| Oil rent                 | 0.0433                            | −0.0352**            | −0.0129** | −0.216*** | −0.0414** | −0.00672 | −0.0238*** | 0.00133 | −0.0174* |
| (0.0315)                 | (0.0179)                          | (0.01620)            | (0.0344) | (0.0209) | (0.0159) | (0.00704) | (0.0121) | (0.0103) |
| Net ODA received         | 0.192***                          | 0.201***             | 0.255*** | 0.0396*** | 0.0558*** | 0.0444  | 0.00411 | 0.0340*** | 0.0457* |
| (0.0580)                 | (0.0125)                          | (0.0367)             | (0.0105) | (0.0224) | (0.0278) | (0.0114) | (0.0116) | (0.0267) |
| Remittances              | 0.0506                            | 0.0150               | −0.0307 | 0.243*** | 0.141*** | 0.138*** | 0.0169  | 0.0126  | 0.0351  |
| (0.0677)                 | (0.0210)                          | (0.101)              | (0.0629) | (0.0225) | (0.0293) | (0.0139) | (0.0374) | (0.0365) |
| Constant                 | 12.24*                            | 18.95***             | 4.057  | −7.196*** | −3.154  | 1.576  | −0.781  | −1.970  | −2.009*  |
| (6.509)                  | (2.018)                           | (3.125)              | (2.280) | (3.085) | (1.264) | (0.505) | (1.500) | (1.108) |
| Observations             | 468                               | 494                  | 468    | 354    | 354    | 374    | 325    | 341    | 341    |
| Number of countries      | 33                                | 33                   | 33     | 33     | 33     | 33     | 33     | 33     | 33     |
| Number of instruments    | 21                                | 34                   | 22     | 33     | 33     | 33     | 33     | 33     | 33     |
| AR (1)                   | 0.00075                           | 0.00407              | 0.0028  | 0.0137 | 0.0156 | 0.0122 | 0.0237 | 0.0147 | 0.0143 |
| AR (2)                   | 0.822                             | 0.753                | 0.931   | 0.0953 | 0.108  | 0.115  | 0.123  | 0.128  | 0.123  |
| Hansen j-test            | 0.381                             | 0.368                | 0.242   | 0.123  | 0.271  | 0.166  | 0.503  | 0.535  | 0.450  |

Source: author

*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Corrected standard errors reported in parenthesis. The coefficients are based on the two-step GMM system estimation, using the finite sample correction of Windmeijer (2005). All explanatory variables are treated as potentially endogenous. The lags of the explanatory variables are taken as an instrument for the difference equation, while the first differences of the explanatory variables are taken as an instrument for the level equation.
Bank (2021), the most widely used indicator is bank credit to the private sector. Financial accessibility is defined by Morduch (1999) as the ease with which people access financial services. For the author, there are four dimensions to affordability: reliability, convenience, continuity, and flexibility. First, “reliability” relates to the availability of resources when they are needed. Next, “convenience” refers to the ease with which customers have access to financial services. “Continuity” refers to the availability in continuous or lasting, that is to say, to accessibility on several occasions. Finally, “flexibility” refers to the fact that the product must be adapted to the real needs of the customers. For Kuzmina et al. (2021), financial efficiency refers to the relationship between the results obtained and the resources used to achieve these results for a financial company. Overall, banking efficiency captures the profitability of banks. These three indicators (depth, accessibility, and efficiency) of the health of the financial system reflect the characteristics of a developed financial system. They are divided into three dimensions: indicators of the financial system as a whole, indicators of financial and banking institutions, and, finally, indicators of the financial market. The advantage with these nine indices is that they accurately reflect the measures of financial development in all their characteristics. In addition, several African countries are considered in the sample. Also, these indices are used more in recent studies (Ahad & Imran, 2021).

Control Variables

Consistent with the literature on the determinants of education (Asongu & Tchamyou, 2019; Asongu et al., 2019; Shields & Menashy, 2019; Yogo, 2017), we consider several control variables, including per capita income, oil rent, official development assistance, and remittances for the baseline result. To test the robustness of the model, we add other control variables such as trade openness, public spending on education, and Foreign Direct Investment (FDI). While the literature agrees on the positive effect of income, remittances, and development assistance on education (Asongu & Tchamyou, 2019; Zhunio et al., 2012), several works on the natural resource curse find that natural resources have a negative effect on education (Gylfason, 2001). In addition, Blanchard and Olney (2017) and Wang and Zhuang (2021) show that trade openness and FDI have positive effects on education, respectively. Thus, we expect a positive effect of trade openness and FDI on the different measures of education used in this study. In the same vein as shown by Qian and Smyth (2011), we also expect a positive effect of public spending on education on educational attainment. Table 1 summarizes the descriptive statistics and data sources. Looking at our three dependent variables, the mean value is the gross enrollment rate above. The mean values by gender also show that education rates remain higher for boys. Table 10 in the Appendix lists the countries in the sample.

Figure 1 shows the relationship between the financial development index and primary and secondary school enrollment. We see that there is a positive relationship between the financial development index and each measure of education.
Similarly, Fig. 2 also shows that there is a positive relationship between financial development and higher education enrollment. In other words, countries with better financial systems have, on average, better education at all levels. This seems consistent with the hypothesis of this study. However, these figures are only stylized facts. We will provide robust evidence in the previous section to confirm these facts.

**Stationary Tests for the Data**

Table 2 presents the result of Fisher unit root on the model’s variables. The results of this test indicate that only financial development, financial institutions, financial market, GDP per capita, oil rent, net ODA, and remittances are stationary at level. Globally, the test suggests that the maximum other of integration if 1.

**Results and Discussion**

This section presents the baseline results and the robustness results.

**Baseline Results**

Table 3 presents the basic results of the effect of financial development on education. The diagnostic tests on dynamic System-GMM reveal the following. All the models passed the AR (2) tests, as indicated by $p$-value showing that the serial correlation in the error terms is not second order. The numbers of instruments are less than the number of groups (i.e., countries). On the whole, the validity of the instruments used as a necessity for System-GMM is confirmed, as indicated by the $p$-values of the Hansen J test. Accordingly, considering all test statistics of these models, we can conclude that the estimated models are adequately specified.

Columns (1) through (3) summarize the results for primary education. In column (1), we find that the coefficient associated with the financial development index is positive and statistically significant. This suggests that financial development increases primary school enrollment. Similarly, in column (2), we also find that the coefficient associated with the financial institutions index is positive and significant. Therefore, financial institutions also improve primary education. In column (3), we find that the financial market index also has a positive and significant effect on primary education in Africa. A comparative analysis of the results shows that the financial development index has on average twice the positive effect on primary education compared to other measures of financial development. From column (4) to column (6), we present results on the effect of financial development on secondary education. The results show that the financial development measure has a positive and significant effect on the gross secondary school enrollment rate. Comparing the results according to the financial development index, we find at this time that the effect of financial institutions is more important. These results show that financial
### Table 4 Additional control variable

| Variable                    | (1)       | (2)       | (3)       | (4)       | (5)       | (6)       | (7)       | (8)       | (9)       |
|-----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| L. dependent variables      | 0.550***  | 0.598***  | 0.705***  | 0.708***  | 0.972***  | 0.772***  | 0.793***  | 0.849***  | 0.718***  |
| (0.0245)                    | (0.0264)  | (0.0293)  | (0.0642)  | (0.0601)  | (0.184)   | (0.0885)  | (0.0624)  | (0.111)   |
| Financial_Dev               | 11.15***  |           |           | 20.58***  |           |           |           | 36.30***  |           |
| (3.878)                     |           |           |           | (7.427)   |           |           |           | (10.75)   |
| Financial_inst              |           |           |           |           | 16.95***  |           |           | 18.72**   |           |
| (5.459)                     |           |           |           |           | (5.895)   |           |           | (8.636)   |
| Financial_market            |           | 11.54***  |           |           |           | 16.79***  |           |           | 48.37**   |
| (3.435)                     |           | (5.895)   |           |           | (5.257)   |           |           | (21.60)   |
| GDP per cap (ln)            | −0.376    | 0.290     | 0.447     | 5.110***  | −1.634    | 2.891     | 1.212     | 1.715     | 2.023     |
| (0.791)                     | (1.433)   | (0.662)   | (1.568)   | (1.890)   | (6.543)   |           | (1.713)   | (1.167)   | (2.083)   |
| Oil rent                    | 0.000480  | 0.0433    | −0.00112  | 0.0465    | 0.0998    | 0.164     | −0.0946   | −0.121*   | −0.273**  |
| (0.0500)                    | (0.0641)  | (0.0348)  | (0.178)   | (0.251)   | (0.237)   |           | (0.101)   | (0.0707)  | (0.123)   |
| Net ODA received            | 0.248***  | 0.383***  | 0.328***  | 0.223***  | 0.222*    | 0.0646    | 0.326**   | 0.392***  | 0.178     |
| (0.0418)                    | (0.0638)  | (0.0679)  | (0.0644)  | (0.132)   | (0.137)   |           | (0.144)   | (0.110)   | (0.203)   |
| Remittances                 | −0.154    | 0.0795    | 0.353**   | 0.838***  | 1.025***  | 0.367     | 0.134*    | 0.112***  | 0.789**   |
| (0.155)                     | (0.267)   | (0.158)   | (0.263)   | (0.265)   | (0.641)   |           | (0.0720)  | (0.0476)  | (0.374)   |
| Trade                       | −0.00786  | −0.0568   | 0.0306    | −0.0289   | 0.0251    | 0.0277    | −0.0458   | −0.0222   | 0.0896*   |
| (0.0116)                    | (0.0372)  | (0.0186)  | (0.0196)  | (0.0516)  | (0.0883)  |           | (0.0468)  | (0.0233)  | (0.0541)  |
| Education expenditure       | 0.216***  | 0.392***  | 0.134     | 0.422***  | 0.395     | 0.234*    | −0.233    | −0.0283   | 0.409     |
| (0.0768)                    | (0.111)   | (0.121)   | (0.139)   | (0.269)   | (0.127)   |           | (0.150)   | (0.0736)  | (0.295)   |
| FDI                         | 0.118**   | 0.151     | 0.0457    | 0.573***  | 0.532***  | 0.162***  | 0.154**   | 0.131***  | 0.0651**  |
| (0.0480)                    | (0.107)   | (0.0790)  | (0.136)   | (0.199)   | (0.0476)  |           | (0.0728)  | (0.0284)  | (0.0290)  |
| Constant                    | 41.75***  | 28.21***  | 24.91***  | −36.49*** | 7.793     | −17.61    | −5.850    | −14.88*** | −16.99    |
| (7.066)                     | (10.44)   | (6.275)   | (7.523)   | (13.49)   | (33.48)   |           | (9.579)   | (5.665)   | (15.15)   |
### Table 4 (continued)

| Dependent var: primary school | Secondary school | Secondary school |
|------------------------------|------------------|------------------|
| (1)                          | (2)              | (3)              | (4) | (5) | (6) | (7) | (8) | (9) |
| Observations                 | 318              | 303              | 303 | 214 | 217 | 189 | 232 | 225 | 232 |
| Number of countries          | 31               | 31               | 31  | 30  | 31  | 28  | 31  | 31  | 31  |
| Number of instruments        | 33               | 27               | 27  | 23  | 21  | 29  | 20  | 26  | 20  |
| AR (1)                       | 0.0023           | 0.0562           | 0.0499 | 0.0456 | 0.0821 | 0.0017 | 0.0139 | 0.0134 | 0.0910 |
| AR (2)                       | 0.731            | 0.481            | 0.737 | 0.847 | 0.272 | 0.481 | 0.430 | 0.760 | 0.214 |
| Hansen j-test                | 0.473            | 0.352            | 0.139 | 0.129 | 0.149 | 0.293 | 0.301 | 0.318 | 0.595 |

Source: author

*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Corrected standard errors reported in parenthesis.
development increases primary and secondary school enrollment in SSA. Through its beneficial effects on job creation (Bruhn & Love, 2014), financial development allows households to increase their income in order to invest in education, which increases school enrollment. Similarly, financial development also increases household spending on education, which increases enrollment rates (Doan et al., 2014). Columns (7) and (9) present the results of the effect of financial development on higher enrollment rates. In each column, we find that the coefficient associated with each measure of financial development is positive and statistically significant. This shows that financial development improves higher education in SSA. These results are similar to the microeconomic work of You and Annim (2014) and Bhuiya et al. (2019) showing that access to credit increases education. Our result can also be put in perspective with the findings of Lochner and Monge-Naranjo (2012) suggesting that credit constraints reduce educational attainment.

Regarding our control variables, we find that they have almost all the expected signs. Specifically, the coefficient associated with GDP per capita is positive and significant in columns (4) and (5). This result confirms that per capita income increases education in Africa. In fact, high level of national production gives the opportunities to household to promote education (Asongu & Tchamyou, 2019). Similarly, official development assistance also has a positive and significant effect on primary and secondary education. Similarly, we find that remittances have a positive and significant effect on secondary education (Asongu & Tchamyou, 2019). These results are broadly consistent with the literature showing beneficial effects of education aid, income, and remittances on education (Zhunio et al., 2012). Consistent with the natural resource curse (Gylfason, 2001), we find that the oil rent acts negatively on education. This result is consistent with that obtained by Farzanegan and Thum (2018) who show that oil rents have a negative effect on the quality of education. However, this result can be justified by the supply of and demand for oil products. In addition, we can add to this justification the hypothesis of the curse of natural resources, which maintains that the more a nation is endowed with natural resources, the lower its development indicators (Farzanegan & Thum, 2018). This result was primarily obtained by Gylfason (2001) who stresses that education is often neglected in resource-rich countries, which may explain the resource curse, particularly in oil-rich countries. In his cross-country regression analysis, he finds that the key education indicators are negatively correlated with resource rents. Indeed, African authorities argue that the benefits of education are long-term, while oil production is profitable in the short term. It increases national income which unfortunately is misused and squandered by corruption.

Robustness Checks

We perform several tests to ensure the robustness of the previous results. First, we estimate our model by introducing several control variables, including trade openness, public spending on education, and FDI. The estimation results are reported in Table 4. From column (1) to column (3), we find that the coefficients associated with the different measures of financial development are all positive and statistically...
This confirms that financial development, financial institutions, and the financial market increase primary education. Similarly, from column (4) to column (6), we also find that the different measures increase secondary education. We can therefore conclude that our results are robust to including additional control variables. From column (7) to column (9), the coefficients associated with the three measures of financial development are once again positive and significant. Regarding these additional control variables, consistent with Qian and Smyth (2011), we find that public spending on education increases primary and secondary school.

### Table 5 Effects of financial development on primary education by gender

|                      | Dependent var: primary school (female) | Primary school (male) |
|----------------------|----------------------------------------|-----------------------|
|                      | (1)         | (2)         | (3)         | (4)         | (5)         | (6)         |
| L. dependent variables | 0.874***   | 0.900***   | 0.924***   | 0.919***   | 0.901***   | 0.908***   |
|                      | (0.0180)   | (0.0167)   | (0.0137)   | (0.0297)   | (0.0251)   | (0.0268)   |
| Financial_Dev        | 4.749***   |             |            | 5.686***   |             |            |
|                      | (1.321)    |             |            | (1.376)    |             |            |
| Financial_inst       | 3.913***   |             |            | 5.137***   |             |            |
|                      | (1.490)    |             |            | (1.633)    |             |            |
| Financial_market     |             | 3.296***   |             | 3.806***   |             |            |
|                      |             | (0.936)    |             | (0.802)    |             |            |
| GDP per cap (ln)     | 0.443      | −0.500     | 0.0404     | −0.310     | −0.412     | −0.00783   |
|                      | (0.307)    | (0.313)    | (0.245)    | (0.259)    | (0.329)    | (0.166)    |
| Oil rent             | 0.000590   | −0.00437   | −0.00249   | −0.0230*** | −0.0231**  | −0.0336*** |
|                      | (0.0134)   | (0.0157)   | (0.0115)   | (0.00706)  | (0.0104)   | (0.00383)  |
| Net ODA received     | 0.135***   | 0.118***   | 0.207***   | 0.193***   | 0.172***   | 0.203***   |
|                      | (0.0354)   | (0.0310)   | (0.0332)   | (0.0364)   | (0.0270)   | (0.0271)   |
| Remittances          | 0.0166     | 0.0199     | 0.0198     | 0.0668     | 0.0608     | 0.0378     |
|                      | (0.0238)   | (0.0282)   | (0.0166)   | (0.0533)   | (0.0483)   | (0.0331)   |
| Constant             | 14.87***   | 12.29***   | 6.378***   | 8.518*     | 10.79**    | 8.274***   |
|                      | (3.087)    | (2.989)    | (1.583)    | (4.496)    | (4.373)    | (2.827)    |
| Observations         | 488        | 462        | 462        | 466        | 462        | 462        |
| Number of countries  | 33         | 33         | 33         | 33         | 33         | 33         |
| Number of instruments| 24         | 24         | 23         | 22         | 23         | 23         |
| AR (1)               | 0.00179    | 0.00149    | 0.00147    | 0.000383   | 0.000376   | 0.000481   |
| AR (2)               | 0.703      | 0.854      | 0.679      | 0.699      | 0.660      | 0.731      |
| Hansen j-test        | 0.175      | 0.322      | 0.145      | 0.142      | 0.405      | 0.121      |

Source: author

*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Corrected standard errors reported in parenthesis. The coefficients are based on the two-step GMM system estimation, using the finite sample correction of Windmeijer (2005). All explanatory variables are treated as potentially endogenous. The lags of the explanatory variables are taken as an instrument for the difference equation, while the first differences of the explanatory variables are taken as an instrument for the level equation.
enrollment. We also show that FDI improves secondary education. This is consistent with Wang and Zhuang (2021) finding that FDI promotes primary school enrollment and completion rates for both boys and girls.

Second, we test the robustness of our results by examining the effect of financial development on primary, secondary, and higher education by gender. This approach examines whether development affects education in SSA differently by gender. Table 5 presents the results of the effect of financial development on primary education by gender. From column (1) to column (3), we present the results for girls’

Table 6 Effects of financial development on secondary education by gender

| Dependent var: secondary school (female) | Secondary school (male) |
|-----------------------------------------|-------------------------|
|                                         | (1)                     | (2)     | (3)     | (4)     | (5)     | (6)     |
| L. dependent variables                  | 0.634***                | 0.533***| 0.885***| 1.014***| 1.064***| 1.012***|
|                                         | (0.0308)                | (0.0453)| (0.0233)| (0.0282)| (0.0423)| (0.00712)|
| Financial_Dev                           | 13.10***                |         |         | 4.114*  |         |         |
|                                         | (2.036)                 |         |         | (2.251) |         |         |
| Financial_inst                          | 14.57**                 | 9.779***|         |         | (5.699) |         |
|                                         | (5.999)                 |         |         | (5.599) |         |         |
| Financial_market                        |                         | 9.779***|         | 1.024*  |         |         |
|                                         |                         | (0.830) |         | (0.616) |         |         |
| GDP per cap (ln)                        | 7.491***                | 8.029***| 2.341***| −0.565  | −0.436  | 0.185*  |
|                                         | (0.804)                 | (1.913) | (0.587) | (0.395) | (1.262) | (0.107) |
| Oil rent                                | −0.519***               | −0.499***| −0.160***| 0.324   | 0.0658  | 0.0135  |
|                                         | (0.0377)                | (0.0802)| (0.0601)| (0.262) | (0.110) | (0.00877)|
| Net ODA received                        | 0.206***                | 0.0903  | 0.133***| 0.129   | 0.267***| 0.182***|
|                                         | (0.0298)                | (0.0680)| (0.0193)| (0.0973)| (0.0771)| (0.0137)|
| Remittances                             | 0.672***                | 0.412   | 0.523***| 0.0544* | −0.00642| 0.0219***|
|                                         | (0.213)                 | (0.333) | (0.0876)| (0.0299)| (0.0572)| (0.00454)|
| Constant                                | −41.02***               | −40.07***| −13.44***| 2.201   | −3.342  | −2.265***|
|                                         | (4.703)                 | (11.12) | (3.237) | (2.938) | (7.210) | (6.615) |
| Observations                            | 370                     | 370     | 370     | 370     | 370     | 370     |
| Number of countries                     | 33                      | 33      | 33      | 33      | 33      | 33      |
| Number of instruments                   | 28                      | 27      | 28      | 18      | 27      | 33      |
| AR (1)                                  | 0.0127                  | 0.0402  | 0.0080  | 0.0080  | 0.0092  | 0.0088  |
| AR (2)                                  | 0.242                   | 0.0862  | 0.419   | 0.102   | 0.116   | 0.101   |
| Hansen j-test                           | 0.161                   | 0.165   | 0.154   | 0.141   | 0.407   | 0.216   |

Source: author

*, **, and *** denote statistical significance at the 10%, 5% and 1% levels respectively. Corrected standard errors reported in parenthesis. The coefficients are based on the two-step GMM system estimation, using the finite sample correction of Windmeijer (2005). All explanatory variables are treated as potentially endogenous. The lags of the explanatory variables are taken as an instrument for the difference equation, while the first differences of the explanatory variables are taken as an instrument for the level equation.

enrollment. We also show that FDI improves secondary education. This is consistent with Wang and Zhuang (2021) finding that FDI promotes primary school enrollment and completion rates for both boys and girls.

Second, we test the robustness of our results by examining the effect of financial development on primary, secondary, and higher education by gender. This approach examines whether development affects education in SSA differently by gender. Table 5 presents the results of the effect of financial development on primary education by gender. From column (1) to column (3), we present the results for girls’
education. We find that the coefficients on each measure of financial development are positive and statistically significant. The financial development index appears to have a larger effect. When we look at boys’ primary education (columns 4–6), we also find that the different measures of financial development increase boys’ education. Comparing the results by gender, we find that financial development improves boys’ primary education more.

In Table 6, we present the results for the effect of financial development on secondary education by gender. The results in the first three columns of the table show that the coefficients associated with each measure of financial development are positive and significant. Thus, financial development, financial institutions, and the financial market increase girls’ secondary education. For boys’ secondary education (columns 4–6), we find that the different measures of financial development have a weak positive effect. Thus, our results suggest that financial development increases primary and secondary education for both girls and boys, although the effect is larger for boys in primary education, in contrast to secondary education where the effect is significantly larger for girls.

The results in Table 7 show the effect of financial development on higher education by gender. In the first three columns, we note that the coefficients associated with the three measures of financial development are positive and statistically significant at the 1\% level. However, when we look at the higher education of boys, we find that only the financial development index has a positive impact. Thus, financial development improves higher education rates in SSA, although there are gender differences. Financial institutions and the financial market have positive and significant effects only for girls.

Third, we test the robustness of the results using alternative measures of financial development. We use the three sub-measures of financial institutions, namely, financial institution depth, financial institution accessibility, and financial institution efficiency. We also use the three sub-measures of the financial market, namely, financial market depth, financial market accessibility, and financial market efficiency. Using these indicators provides accurate information on the financial development measures that improve education in SSA. Table 7 summarizes the results of the effect of financial institution sub-measures on education. From column (1) to clone (6), we find that the coefficients associated with the depth of financial institutions and the accessibility of financial institutions are positive and significant. These results suggest that the depth and accessibility of financial institutions increase primary and secondary education. However, the effect of the efficiency of financial institutions is not significant. Regarding higher education, the coefficients associated with all three measures of financial institutions are positive and significant. The effect of the depth of financial institutions is more significant, as in the case of primary education.

In Table 8, we present the results of the effect of financial market sub-measures on education. For primary education, we find that financial market depth and financial market efficiency have a positive and statically significant effect, the effect of financial market efficiency being larger. Thus, greater financial market depth coupled with financial market efficiency increases primary education in Sub-Saharan Africa. From column (4) to column (6), we find that the coefficients associated with each of the financial market sub-measures are positive and statistically significant.
Thus, the depth, accessibility, and efficiency of the financial market increase secondary education. Comparing the two education cycles (primary and secondary), we find that the financial market measures increase secondary education more. Similarly, from column (7) to column (9), we find that all three financial market measures increase higher education, although the effect is smaller compared to primary and secondary education.

In Table 9, we present the results of the effect of financial market sub-measures on education. For primary education, we find that financial market depth and financial market efficiency have a positive and statistically significant effect, the effect of
Table 8  Effects of different measures of financial institutions on education

|                      | Dependent var: primary school | Secondary school | Tertiary school |
|----------------------|-------------------------------|------------------|----------------|
|                      | (1)                           | (2)              | (3)            |
|                      | (4)                           | (5)              | (6)            |
|                      | (7)                           | (8)              | (9)            |
| **L. dependent variables** | 0.812***                      | 0.767***         | 0.864***       |
|                      | (0.0170)                      | (0.0235)         | (0.0294)       |
| Financial inst_depth | 5.148***                      | 0.418***         | 4.963**        |
|                      | (0.684)                       | (0.157)          | (2.460)        |
| Financial inst_accessibility | 2.955**                      | 2.868***         | 2.981***       |
|                      | (1.093)                       | (0.925)          | (0.907)        |
| Financial inst_efficiency | 0.677                         | 0.677            | 0.976          |
|                      | (2.879)                       | (0.926)          | (0.671)        |
| GDP per cap (ln)    | 0.268                         | 0.226            | 0.435          |
|                      | (0.249)                       | (0.312)          | (0.508)        |
| Oil rent            | 0.0590                        | –0.0287*         | –0.133         |
|                      | (0.0433)                      | (0.0167)         | (0.119)        |
| Net ODA received    | 0.202***                      | 0.201***         | 0.187***       |
|                      | (0.0284)                      | (0.0157)         | (0.0598)       |
| Remittances         | –0.0543                       | –0.00534         | 0.104*         |
|                      | (0.0556)                      | (0.0413)         | (0.0568)       |
| Constant            | 19.54***                      | 20.50***         | 20.99***       |
|                      | (2.790)                       | (4.665)          | (3.930)        |
| Observations        | 494                           | 468              | 494            |
| Number of countries | 33                            | 33               | 33             |
| Number of instruments | 28                            | 30               | 15             |
| AR(1)               | 0.0009                        | 0.0009           | 0.00120        |
| AR(2)               | 0.727                         | 0.823            | 0.696          |
| Hansen j-test       | 0.145                         | 0.194            | 0.192          |

Source: author

* , **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Corrected standard errors reported in parenthesis. The coefficients are based on the two-step GMM system estimation, using the finite sample correction of Windmeijer (2005). All explanatory variables are treated as potentially endogenous. The lags of the explanatory variables are taken as an instrument for the difference equation, while the first differences of the explanatory variables are taken as an instrument for the level equation.
### Table 9 Effects of different measures of financial market on education

| Dependent var: primary school | Secondary school | Tertiary school |
|------------------------------|------------------|----------------|
| (1)                          | (4)              | (7)            |
| (2)                          | (5)              | (8)            |
| (3)                          | (6)              | (9)            |
| L. dependent variables       |                  |                |
| 0.920***                     | 0.909***         | 0.918***       |
| (0.0310)                     | (0.0142)         | (0.00793)      |
| Financial_market_depth       |                  |                |
| 1.60                         | 4.728***         | 0.537*         |
| (1.016)                      | (0.598)          | (0.322)        |
| Financial_market_accessibility |                |                |
| 0.720**                      | 2.369***         | 1.798***       |
| (0.350)                      | (0.455)          | (0.383)        |
| Financial_market_efficiency  |                  |                |
| 2.164***                    | 2.986***         | 1.572*         |
| (0.400)                      | (0.147)          | (0.986)        |
| GDP per cap(ln)              |                  |                |
| 0.217                        | 1.224***         | 0.0843         |
| (0.196)                      | (0.286)          | (0.0993)       |
| Oil rent                     |                  |                |
| −0.0014                      | −0.128***        | −0.044***      |
| (0.0131)                     | (0.0227)         | (0.00963)      |
| Net ODA received             |                  |                |
| 0.234***                     | 0.0509***        | 0.0218***      |
| (0.0460)                     | (0.00722)        | (0.00753)      |
| Remittances                  |                  |                |
| −0.0581                      | 0.257***         | 0.0468*        |
| (0.123)                      | (0.0649)         | (0.0073)       |
| Constant                     |                  |                |
| 5.570                        | −5.028***        | −0.758         |
| (3.720)                      | (1.607)          | (0.901)        |
| Observations                 |                  |                |
| 494                          | 374              | 341            |
| Number of countries          |                  |                |
| 33                           | 33               | 33             |
| Number of instruments        |                  |                |
| 22                           | 28               | 28             |
| AR (1)                       | 0.0000885        | 0.0000539      |
| AR (2)                       | 0.00104          | 0.00130        |
| Hansen j-test                | 0.159            | 0.116          |

Source: author

*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Corrected standard errors reported in parenthesis. The coefficients are based on the two-step GMM system estimation, using the finite sample correction of Windmeijer (2005). All explanatory variables are treated as potentially endogenous. The lags of the explanatory variables are taken as an instrument for the difference equation, while the first differences of the explanatory variables are taken as an instrument for the level equation.
financial market efficiency being larger. Thus, greater financial market depth coupled with financial market efficiency increases primary education in Sub-Saharan Africa. From column (4) to column (6), we find that the coefficients associated with each of the financial market sub-measures are positive and statistically significant. Thus, the depth, accessibility, and efficiency of the financial market increases secondary education. Comparing the two education cycles (primary and secondary), we find that the financial market measures increase secondary education more. Similarly, from column (7) to column (9), we find that all three financial market measures increase higher education, although the effect is smaller compared to primary and secondary education.

Conclusion

In this paper, we analyzed the contribution of financial development on education (primary, secondary, and tertiary) in a panel of 37 sub-Saharan African countries over the period 2000 to 2018. It is widely accepted that most of Africa’s education and training programs suffer from low level of bank financing, as well as income inequalities and exclusion at all levels. Even with a substantial increase in the number of children with access to basic education, a large number still remain out of school. A large number of young people stop their school program without enrolling in secondary and university. The lack of financial resources is presented as the main reason. The scarcity of work on this subject in Africa, the consideration of the three levels of education, the different indices of financial development, and the gender perspective are the main motivations for writing this article. In presence of endogeneity issues, the regression analysis using the system generalized method of moment estimator technique shows that financial development increases the different levels of education. Sensitivity analysis using more control variables, gender issue, and another measure of financial development leads us to confirm the results obtained in the basic estimation. Thus, financial development through its nine proxies developed by the IMF and taken up by Svirydzenka (2016) contributes to increasing the level of education in SSA.

This article, which contributes strongly to the theoretical and empirical literature on the subject, leads us to formulate four main economic implications. First, financial systems in Africa must be more inclusive to enable a large part of the population to benefit from credit. Second, per capita growth must be accelerated to guarantee higher household income allowing them to easily find bank financing. Third, at the higher level, the state must guarantee bank loans allocated to students, which they will repay with their first job. Fourth, we must encourage bank financing for the education of the girl child. Global statistics show that if young girls are more educated, then literacy levels will increase.
Appendix

Table 10  List of the countries

| Country          | Region                          |
|------------------|---------------------------------|
| Benin            | Central African Republic        |
| Botswana         | Chad                            |
| Burkina Faso     | Comoros                         |
| Burundi          | Congo, Dem. Rep                 |
| Cabo Verde       | Congo, Rep                      |
| Cameroon         | Cote d’Ivoire                   |
| Eritrea          | Eswatini                        |
| Kenya            | Lesotho                         |
| Mauritius        | Mozambique                      |
| Sao Tome and Principe | Senegal                  |
| Botswana         | Chad                            |
| Burkina Faso     | Comoros                         |
| Burundi          | Congo, Dem. Rep                 |
| Cabo Verde       | Congo, Rep                      |
| Cameroon         | Cote d’Ivoire                   |
| Eritrea          | Eswatini                        |
| Kenya            | Lesotho                         |
| Mauritius        | Mozambique                      |
| Sao Tome and Principe | Senegal                  |
| Botswana         | Chad                            |
| Burkina Faso     | Comoros                         |
| Burundi          | Congo, Dem. Rep                 |
| Cabo Verde       | Congo, Rep                      |
| Cameroon         | Cote d’Ivoire                   |
| Eritrea          | Eswatini                        |
| Kenya            | Lesotho                         |
| Mauritius        | Mozambique                      |
| Sao Tome and Principe | Senegal                  |
| Botswana         | Chad                            |
| Burkina Faso     | Comoros                         |
| Burundi          | Congo, Dem. Rep                 |
| Cabo Verde       | Congo, Rep                      |
| Cameroon         | Cote d’Ivoire                   |
| Eritrea          | Eswatini                        |
| Kenya            | Lesotho                         |
| Mauritius        | Mozambique                      |
| Sao Tome and Principe | Senegal                  |

References

Ahad, M., & Imran, Z. A. (2021). “Does governance quality matter for the development of financial institutions in Pakistan ?”. *Journal of Economic and Administrative Sciences*. Ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JEAS-03-2021-0061

Anyanwu, J. C. (2012). Developing knowledge for the economic advancement of Africa. *International Journal of Academic Research in Economics and Management Sciences*, 1(2), 73–111.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2), 277–297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29–51.

Arora, U. R., & Ratnasiri, S. (2011). School financial development, financial inclusion and human capital: How close is the link? A study of India. *Griffith Business*.

Asongu, S. A. (2017). Knowledge economy gaps, policy syndromes, and catch-up strategies: Fresh South Korean lessons to Africa. *Journal of the Knowledge Economy*, 8(1), 211–253.

Asongu, S. A., & Tchamyou, V. S. (2019). Foreign aid, education and lifelong learning in Africa. *Journal of the Knowledge Economy*, 10(1), 126–146.

Asongu, S. A., Orim, S. M. I., & Nting, R. T. (2019). Inequality, information technology and inclusive education in sub-Saharan Africa. *Technological Forecasting and Social Change*, 146, 380–389.

Atsu, F., Adams, S., & Adjei, J. (2021). ICT, energy consumption, financial development, and environmental degradation in South Africa. *Heliyon*, 7(7), e07328. https://doi.org/10.1016/j.heliyon.2021.e07328

Banerjee, A. V., & Newman, A. F. (1993). Occupational choice and the process of development. *Journal of Political Economy*, 101, 274–298.

Becker, G. (1964). *Human capital* (p. 187). Columbia University Press.

Beck, T., Levine, R., & Loayza, N. (2000). Finance and the sources of growth. *Journal of Financial Economics*, 58(1–2), 261–300. https://doi.org/10.1016/s0304-405x(00)00072-6

BEI (2020), *Le secteur bancaire en Afrique : financer la transformation sur fond d’incertitude*, Banque européenne d’investissement, Luxembourg, 246p.

Benabou, R. (2003). Human capital, technical change, and the welfare state. *Journal of the European Economic Association*, 1, 522–532.

Bencivenga, V. R., & Smith, B. D. (1991). Financial Intermediation and Endogenous Growth. *Review of Economics Studies*, 58, 195–209.

Bhuiya, M. M. M., Khanam, R., Rahman, M. M., & Nghiem, S. (2019). Microcredit participation and child schooling in rural Bangladesh: Evidence from a cross-sectional survey. *Economic Analysis and Policy*, 64, 293–301.

Blanchard, E. J., & Olney, W. W. (2017). Globalization and human capital investment: Export composition drives educational attainment. *Journal of International Economics*, 106, 165–183.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115–143.
Bond, S. R., Hoeffler, A., & Temple, J. R. (2001). GMM estimation of empirical growth models. Available at SSRN 290522.

Bruhn, M., & Love, I. (2014). The real impact of improved access to finance: Evidence from Mexico. The Journal of Finance, 69(3), 1347–1376.

Burdett, K., & Smith, E. (2002). The low skill trap. European Economic Review, 46(8), 1439–1451. https://doi.org/10.1016/S0014-2921(02)00184-8

Chandra, D. S., & Yokoyama, K. (2011). The role of good governance in the knowledge-based economic growth of East Asia: A study on Japan. Newly Industrialized Economies. Graduate School of Economics, Kyushu University.

Chavula, H. K. (2010). The role of knowledge in economic growth. The African perspective. ICT, Science and Technology Division (ISTD), United Nations Economic Commission for Africa (UNECA).

Chen, H., & Volpe, R. P. (1998). An analysis of personal financial literacy among college students. Financial Services Review, 7(2), 107–128.

Doan, T., Gibson, J., & Holmes, M. (2014). Impact of household credit on education and healthcare spending by the poor in peri-urban areas. Vietnam. Journal of Southeast Asian Economies, 87–103.

Doll, K. (2000). Who would use financial counseling and planning services on university campuses? Proceedings of the Association for Financial Counseling and Planning and Education, 122–131.

Eryiğit, S. B., Eryiğit, K. Y., & Dülgeroğlu, E. (2015). Local financial development and capital accumulations: Evidence from Turkey. Panoeconomicus, 62(3), 339–360.

Farzanegan, M. R., & Thum, M. (2018). Does oil rents dependency reduce the quality of education? Empirical Economics. https://doi.org/10.1007/s00181-018-1548-y

Galletta, S., Mazzù, S., Naciti, V., & Vermiglio, C. (2020). Sustainable development and financial institutions: Do banks’ environmental policies influence customer deposits? Business Strategy and the Environment, 30(1), 643–656. https://doi.org/10.1002/bse.2644

Galor, O., & Zeira J. (1993). Income Distributions and Macroeconomics. Review of Economic Studies, 60, 35–52.

Greenwood, J., & Jovanovic, B. (1990). Financial development, growth, and the distribution of income. Journal of Political Economy, 98, 1076–1107.

Gylfason, T. (2001). Natural resources, education, and economic development. European Economic Review, 45(4–6), 847–859.

Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating vector autoregressions with panel data. Econometrica: Journal of the Econometric Society, 1371–1395.

Ibrahim, M., & Alagidede, P. (2018). Nonlinearities in financial development economic growth nexus: Evidence from sub-saharan Africa. Research in International Business and Finance, 46, 95–104.

IMF (2020). Financial development index, international monetary fund, https://data.imf.org/?sk=F8032E80-B36C-43B1-AC26-493C5B1CD33B

Ibrahim, M., & Alagidede, P. (2018). Nonlinearities in financial development economic growth nexus: Evidence from sub-saharan Africa. Research in International Business and Finance, 46, 95–104.

Kaulihowa, T., & Adjasi, C. (2019). Non-linearity of FDI and human capital development in Africa. Transnational Corporations Review, 11(2), 133–142.

Kuepie, M., Nordman, C. J., & Roubaud, F. (2009). Education and earnings in urban West Africa. Journal of Comparative Economics, 37(3), 491–515. https://doi.org/10.1016/j.jce.2008.09.007

Laitner, J. (2000). Structural change and economic growth. The Review of Economic Studies.

Levine, R. (1997). Financial development and economic growth: Views and agenda. Journal of Economic Literature, 35(2), 688–726.

Levine, R. (2005). Chapter 12 finance and growth: theory and evidence. Handbook of Economic Growth, 865–934. https://doi.org/10.1016/s1574-0684(05)01012-9.

Levine, R., Norman, L., & Beck, T. (2000). Financial intermediation and growth: Causality and causes. Journal of Monetary Economics, 46(1), 31–77.

Levine, R., & Zervos S. (1998). Stock markets, banks, and economic growth. American Economic Review, 88, 537–558.

Lochner, L., & Monge-Naranjo, A. (2012). Credit constraints in education. Annu. Rev. Econ., 4(1), 225–256.

Lucas, R. (1988). On the mechanics of economic development. Journal of Monetary Economics, 22, 3–42.

Lyons, A. C. (2003). The credit usage and financial education needs of midwest college students. University of Illinois at Urbana-Champaign.

Lyons, A. C. (2004). A profile of financially at-risk college students. The Journal of Consumer Affairs, forthcoming.
Lyons, A. C., & Andersen, P. (2002). Credit usage of college students: Evidence from the University of Illinois. *University of Illinois at Urbana-Champaign.*

Mankiw, G., & N., Romer, D. & Weil, D.N. (1992). A Contribution to the empirics of economic growth. *The Quarterly Journal of Economics, 107*(2), 407–437. [https://doi.org/10.2307/2118477](https://doi.org/10.2307/2118477)

Morduch, J. (1999). The microfinance promise. *Journal of Economic Literature XXXVII,* 1569–1614

Nguyen, C. P., & Su, T. D. (2021). Export quality dynamics: Multidimensional evidence of financial development. *The World Economy.*

Nguyen, C. P., Schinckus, C., & Su, T. D. (2020). The drivers of economic complexity: International evidence from financial development and patents. *International Economics, 164,* 140–150.

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica: Journal of the econometric society,* 1417–1426.

Ouedraogo, I., Ngoa Tabi, H., & Atangana Ondoa, H. (2021). Effets de la qualité des institutions sur l’éducation en Afrique. *African Development Review.*

Park, H., & Kim, J. D. (2020). Transition towards green banking: Role of financial regulators and financial institutions. *Asian Journal of Sustainability and Social Responsibility, 5*(1), 1–25.

Pilcher, A., & Haines, T. (2000). Peer financial counseling: From one student to another. *Proceedings of the Association for Financial Counseling and Planning Education, 132.*

Qian, J. X., & Smyth, R. (2011). Educational expenditure in urban China: Income effects, family characteristics and the demand for domestic and overseas education. *Applied Economics, 43*(24), 3379–3394.

Romer, M. P. (1990). Capital, labor, and productivity. *Brookings Papers on Economic Activity. Microeconomics, 1990*(1990), 337–367.

Ross, C. E., & Bird, C. E. (1994). Sex stratification and health life style: Consequences for men’s and women’s perceived health. *Journal of Health and Social Behavior, 35*(2), 161. [https://doi.org/10.2307/2137363](https://doi.org/10.2307/2137363)

Roodman, D. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics, 71*(1), 135–158.

Schultz, T. (1961). Investment in human capital. *The American Economic Review, 51*(1), 1–17. Retrieved April 14, 2021.

Schumpeter, J. A. (1911). *Theorie der wirtschaftlichen Entwicklung.* Duncker & Humblot.

Shields, R., & Menashy, F. (2019). The network of bilateral aid to education 2005–2015. *International Journal of Educational Development, 64,* 74–80.

Sivakumar, M. & Sarvalingam, A. (2010). Human deprivation index: A measure of multidimensional poverty. *Munich Personal RePEc Archive*

Smith, A. (1776). An inquiry into the nature and causes of the wealth of nations. *London: W. Stahan f3 T. Cadell,* 1776

Svirydzenka, K. (2016). Introducing a new broad-based index of financial development. IMF Working Paper No. 16/5. Available at SSRN: [https://ssrn.com/abstract=2754950](https://ssrn.com/abstract=2754950)

Tadros, E., & Wootton, H. (2020). How the big consultants are cutting costs amid COVID-19. *Australian Financial Review.*

Tchamyou, V. S. (2017). The role of knowledge economy in African business ». *Journal of the Knowledge Economy, 8*(4), 1189–1228.

Uddin, M. A., Ali, M. H., & Masih, M. (2017). Political stability and growth: An application of dynamic GMM and quantile regression. *Economic Modelling, 64,* 610–625.

Varcoe, K., Peterson, S., Garrett, C., Martin, A., René, P., & Costello, C. (2001). What teens want to know about financial management. *Journal of Family and Consumer Sciences, 93*(2), 30–34.

Wang, M., & Zhuang, H. (2021). FDI and educational outcomes in developing countries. *Empirical Economics,* 1–35.

Weston, M. B. (2001). Creating a financial path to graduation. *Proceedings of the Association for Financial Counseling and Planning Education, 131*

Williams, P. Meredith, O. Justin, R., & Jacolyn, M. N. (2013). An applied framework for positive education. *The International Journal of Wellbeing*

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics, 126*(1), 25–51.

World Bank. (2021). World development indicators. Available at [https://databank.worldbank.org/source/world-development-indicators](https://databank.worldbank.org/source/world-development-indicators).

Yogo, T. U. (2017). Assessing the effectiveness of foreign aid in the education sector in Africa: The case of primary education. *African Development Review, 29*(3), 389–402.
You, J., & Annim, S. (2014). The impact of microcredit on child education: Quasi-experimental evidence from rural China. *Journal of Development Studies, 50*(7), 926–948.

Zhunio, M. C., Vishwasrao, S., & Chiang, E. P. (2012). The influence of remittances on education and health outcomes: A cross country study. *Applied Economics, 44*(35), 4605–4616.

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