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Foreign aid, education and lifelong learning in Africa

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Abstract

This study investigates the effect of foreign aid on education and lifelong learning in 53 African countries for the period 1996-2010. Three main issues are assessed, notably: (i) the effect of aid on education; (ii) the incremental impact of aid on education and (iii) the effect of aid on lifelong learning. Lifelong learning is measured as the combined knowledge acquired during the primary, secondary and tertiary levels of education. Foreign aid dynamics include: Total aid, aid from Multilateral Donors (MD) and aid from the Development Assistance Committee (DAC) countries. The empirical evidence is based on an endogeneity-robust Generalized Method of Moments. The following findings are established. First, the aid variables have positive effects on primary school enrolment and lifelong learning, with the exception of aid from MD which positively affects only lifelong learning. Second, the positive effect on primary school enrolment consistently has a higher magnitude compared to the corresponding impact on lifelong learning. Third, the effects of aid dynamics on secondary and tertiary school enrolments are not significant. We also contribute to the literature by proposing an indicator of lifelong learning for developing countries.

JEL Classification: I20; I28; F35; O55; P16
Keywords: Lifelong learning; Foreign aid; Development; Africa

1. Introduction

The globalisation phenomenon is today an ineluctable process which can be ignored only by sacrificing the progress of nations. It has been become abundantly clear that for nations to be competitive and involved with the global economy, they have to keep-up with the rules of competition that characterise globalisation. Competition in the twenty-first century is substantially centred on knowledge economy (KE), which has been a key theme in World Bank and the Organization of Economic Co-operation and Development (OECD) reports since the beginning of the third millennium (Tchamyou, 2015). These dynamics of KE have been well understood by developed countries (e.g., Europe and North America) which are inexorably charting the pattern of development in the international arena. In calculated steps, Asia and Latin America have been increasingly articulating KE in their implementation of regional and national programs (Dahlman, 2007; Chandra & Yokoyama, 2011). The pattern of the Japanese KE has set the course for Malaysia, China and the Newly Industrialized Economies of Asia (Singapore, Taiwan, Hong Kong and South Korea), which have been experiencing a remarkable transition from 'product-based economies' to 'knowledge-based economies'.

In light of the above, there has been growing interest in the relevance of KE in developing countries, especially those in Africa: a continent which has been documented to be lagging substantially in terms of KE relative to other regions of the world (Anyanwu, 2012). Currents in this stream of KE literature have included, inter alia: (i) general discourses on KE (Aubert, 2005; Rooney, 2005; Lin, 2006; Makinda, 2007; Anyanwu, 2012); (ii) education (Weber, 2011; Kamara et al., 2007; Amavilah, 2009; Ford, 2007; Oluwatobi & Olurinola, 2015); (iii) indigenous knowledge systems (Lwoga et al., 2010; Raseroka, 2008); (iv) communication and information technologies (Maurer, 2008; Jonathan & Camilo, 2008; Aker & Mbiti, 2010; Ondiege, 2010; Chavula, 2010; Merritt, 2010; Butcher, 2011; Thacker, & Wright, 2012; Penard et al., 2012; Demonbynes & Thegeya, 2012; Asongu, 2013a, 2014a); (v) economic incentives and institutional regime (Andrés & Asongu, 2013a; Cogburn, 2003; Letiche, 2006); (vi) innovation (Oyelaran-Oyeyinka & Sampath, 2007; Carisle et al., 2013; Oluwatobi et al., 2014); (vii) intellectual capital and economic development (Wagiciengo & Belal, 2012; Preece, 2013); (viii) research and development (Sumberg, 2005; German & Stroud, 2007); (ix) intellectual property rights (Zerbe, 2005; Lor & Britz, 2005; Myburgh, 2011; Asongu, 2013b, 2015a; Andrés & Asongu, 2013ab; Andrés et al., 2014); (x) spatiality in knowledge production (Bidwell et al.,

2011; Neimark, 2012); (xi) KE in the transformation of space (Moodley, 2003; Maswera et al., 2008); (xii) KE related to finance (Asongu, 2013c, 2014b, 2015b) and (xiii) KE convergence or catch-up in light of the development miracle from East Asia (Kim et al., 2012; Bezmen & Depken, 2004; Andrés et al., 2014; Andrés & Asongu, 2013ab; Asongu, 2015bc, 2013de).

There has also been an evolving literature on the effect of development assistance on development outcomes in the African continent. Some recent studies include: (i) Gyimah-Brempong and Racine (2014) and Kargbo and Sen (2014) on the positive impact of development assistance on economic growth and (ii) the potentially questionable economics of development assistance with notable works from Banuri (2013), Krause (2013), Ghosh (2013), Monni and Spaventa (2013), Wamboye et al. (2013), Titumir and Kamal (2013), Quartey and Afful-Mensah (2014) and Asongu (2014c, 2015de). Consistent with Amin (2014), foreign aid to developing countries could be principally motivated by neo-colonialism. Quartey and Afful-Mensah (2014) have established that there is need for African countries to reconsider their overly reliance on foreign aid by assessing alternative sources of finance. The stances of Afful-Mensah, Amin and Quartey are in line with: (i) Ndlovu-Gatsheni (2013) on the entrapment of Africa into neocolonial 'foreign aid influential webs' and (ii) Kindiki (2011) on the imperative for Africa to limit its overly dependence on foreign aid. Obeng-Odoom (2013) has recommended that foreign aid oriented policies should be based essentially on the fundamental needs of citizens in recipient nations. The position of Obeng-Odoom is shared by Arthur and Quartey (2008) who have expressed the need for a more holistic approach to foreign aid location decisions: an approach that takes into account all stakeholders in international policies for migration management.

Noticeable in the above literature and to the best of our knowledge, very few studies have assessed the relevance of foreign aid in KE in developing countries. As far as we have reviewed, studies closest to this line of inquiry are: Asiedu and Nandwa (2007); Preece (2013) and Asiedu (2014). Asiedu and Nandwa (2007) have investigated if development assistance in education affects economic growth by disaggregating data into: (i) primary, secondary and tertiary education and (ii) low and middle income countries. The study finds that the impact of foreign aid varies (in sign and magnitude) depending on the type of aid and income category. Preece (2013) has engaged the nexus between the international agenda for lifelong learning and financial aid to low income nations (especially those from Africa) to show that international aid priorities negatively affect government policies and choices for lifelong learning in recipient countries.

Asiedu (2014) has examined if foreign aid in education significantly influences growth in Sub-Saharan Africa to conclude that, aid in education (especially primary schooling) broadly has a positive effect on growth.

In light of the above, this study contributes to the KE and foreign aid literature by investigating the effect of foreign aid on education and lifelong learning in 53 African countries for the period 1996-2010. Lifelong learning is measured as the combined knowledge acquired during the primary, secondary and tertiary levels of education. Foreign aid dynamics include: Total aid, aid from Multilateral Donors (MD) and aid from the Development Assistance Committee (DAC) countries. The empirical evidence is based on an endogeneity-robust Generalized Method of Moments.

We also contribute to the existing literature by introducing a measure of lifelong learning in African countries. This is essentially because, despite textual African related foreign aid and lifelong learning literature (Preece, 2013), a measure of lifelong learning with which to extend the underlying literature is missing. After exploring a substantial bulk of literature on education and lifelong learning, Tuijnman (2003) has concluded that an all-inclusive lifelong learning indicator could only be comprehensively derived in the distant future: "*But given the current state of play of the social sciences, and in particular of survey practice and indicator measurement, the time when a holistic and comprehensive framework of lifelong learning indicators can be proposed lies far in the future*" (p.471). Moreover, "*To date only two macro level studies, i.e. the European Lifelong Learning Indicators (ELLI) instrument developed by the EU (2010) and the Composite Learning Index (CLI) instrument developed by the Canadian Council on Learning (undated.), have dealt with this issue*" (Luo, 2015, p.19). While the ELLI is exclusively focused on European countries, the CLI is Canada's indicator for progress in lifelong learning. Consistent with Asongu and Nwachukwu (2015a), these two indicators consists of dimensions of 'learning to be', 'learning to live together', 'learning to do' and 'learning to know'. There are two principal drawbacks in the application of these indicators to African countries: (i) they are exclusively focused on Canada and European countries and (ii) to the best of our knowledge, only data on the dimension of 'learning to know' is available for African countries. Hence, lifelong learning within the framework of this study is defined as the combined knowledge acquired during primary, secondary and tertiary educational levels.

The interest of examining the effect of foreign aid on education and lifelong learning is at least fourfold, notably: (i) the critical role of lifelong learning in Africa when the continent is lagging in terms of knowledge economy (KE) which is essential for 21st century economic prosperity; (ii) contributing to the growing debates on the effects of foreign aid; (iii) extending a new stream of learning literature and (iv) engaging a new paradigm on 'soft economics' which has been built on foreign aid misallocation and growing poverty levels in Africa. First, the relevance of lifelong learning in African KE is crucial because, there is some growing disturbing evidence that the knowledge index of the continent has dropped during the period 2000 to 2009 and remains substantially below those of other regions in the world (Anyanwu, 2002). This has led to a growing stream of studies on KE that are essentially motivated by the need for more KE on the continent (Tchamyou, 2015; Asongu, 2015c).   Second, complementary to the foreign aid literature engaged above, international aid policies are distorting lifelong learning policies in African countries (Preece, 2013). Third, the paper extends an interesting strand of studies on achieving development success based on learning from different activities (Nyarko, 2013) or success strategies (Lee, 2009; Lee & Kim, 2009; Wa Gĩthĩnji & Adesida, 2011; Babatunde, 2012; Fosu, 2013).

Fourth, we engage a new paradigm on 'soft economics' which has been built on foreign aid misallocation and growing poverty levels in Africa. Accordingly, the April 2015 World Bank report on Millennium Development Goals has revealed that extreme poverty has been decreasing in all regions of the world with the exception of Africa (World Bank, 2015; Caulderwood, 2015), in spite of over two decades of growth resurgence that began in the mid 1990s (Fosu, 2015a, p.44). The concern about exclusive growth in Africa has motivated a recent book by Kuada (2015) which proposes a new paradigm of 'soft economics' as means to understanding African development trends[1]. Kuada (2015) has postulated that the introduction of human capability development and emphasis on 'soft economics' as opposed to 'strong economics' (or structural adjustment policies) are crucial in assessing and understanding recent trends in African development that have been characterized by exclusive growth, high unemployment and increasing poverty levels. The narrative of Kuada (2015) on 'soft economics' for inclusive growth, poverty alleviation and employment in Africa is consistent with a recent stream of

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[1] The issue of exclusive growth is also the focus of a recent book by Fosu (2015bc) which is devoted to elucidating: (i) the role of institutions in the underlying growth resurgence and (ii) myths behind Africa's recent growth resurgence.

African development literature that has focused on the imperative to tailor development assistance towards alternative mechanisms in order to ultimately boost employment, improve human resources and reduce poverty (Simpasa et al., 2015; Page & Shimeles, 2015; Jones et al., 2015; Asongu, 2015f; Jones & Tarp, 2015; Page & Söderbom, 2015).

In light of the above, four problems boldly standout, notably: (i) Africa's lagging position in knowledge acquisition in spite of the growing relevance of KE in 21st century development; (ii) the conclusions of Preece (2013) that need to be empirically verified; (iii) the need to extend a growing stream of literature on using foreign aid for soft economics in view of improving human resources that are essential for poverty reduction and increasing employment and (iv) the absence of an indicator of lifelong learning for developing countries. Hence, the objective of this inquiry is to assess the effect of foreign aid on education and lifelong learning in Africa. Three main issues are assessed, notably: (i) the effect of aid on education; (ii) the incremental impact of aid on education and (iii) the effect of aid on lifelong learning. The rest of the study is organized as follows. Section 2 discusses the data and the methodology. The empirical results are covered in Section 3. Section 4 concludes.

2. Design and Methods

2.1 Design

We investigate a panel of 53 African countries with data of annual periodicity from African Development Indicators of the World Bank for the period 1996-2010. The interest of the sampled periodicity is to obtain results that are more relevant for fresh policy implications. The scope of Africa is in accordance with Preece (2013) which is partially motivating this line of inquiry. We measure the dependent variable of lifelong learning as the first principal component of primary, secondary and tertiary school educations. This dependent variable of interest is complemented with its constituent components to fully assess the difference between the effects on distinct components of lifelong learning and lifelong learning. The corresponding principal component analysis is discussed in Section 2.1 below.

Net official development assistance (NODA) is employed as the independent variable of interest. To add subtlety to the analysis, in a bid for robustness, NODA from Multilateral Donors (MD) and NODA from the Development Assistance Committee (DAC) countries are also used independently of the baseline Total NODA. Hence, we do not expect these aid variables to have

different effects (in terms of significance and signs of estimates) on education and lifelong learning. However, we expect changes in the magnitude of significance on the dependent variables. Consistent with Andrés et al. (2015) in the KE literature, we control for trade openness, inflation, government expenditure and economic prosperity. We expect government expenditure, GDP growth and trade openness to positively affect lifelong learning, whereas inflation should have the opposite effect. Accordingly, government expenditure could promote lifelong learning if it is not captured by mismanagement and corruption. Economic prosperity and trade openness from intuition should be favorable to learning (Asongu, 2014c). Inflation could reduce expectations in the return on education and hence, reduce investment in long-term education. Definition of the variables, the summary statistics and correlation matrix are detailed in the Appendices. The summary statistics informs us that variables are comparable and display quite some significant variations such that we can be comfortable that reasonable estimation nexuses would emerge. The correlation matrix essentially serves to control for concerns of overparameterization and multicollinearity.

2.2 Methods

2.2.1 Principal component analysis

The concept of lifelong learning is multidimensional and complex to calibrate, essentially because it involves a learning process from birth to death. Moreover, to the best of our knowledge there is yet no universally acceptable indicator for the measurement of the phenomenon (Kirby et al., 2010). In this study, we define lifelong learning as the formal educational process entailing primary, secondary and tertiary schoolings. Hence, the phenomenon could also be appreciated as the combined knowledge gained in the course of these three levels of formal education (Asongu, 2015g; Tchamyou, 2015).

In light of the above, we use principal component analysis (PCA) to measure this combined knowledge gained. PCA is a common statistical technique that is employed to reduce a large set of highly correlated variables into a smaller set of variables that are uncorrelated but represent significant information in the constituent indictors. The Kaiser (1974) and Jolliffe (2002) criteria are used to retain the principal information contained in the three educational components. The criteria require that only principal components with an eigenvalue greater than the mean (or one) should be retained. As shown in Table 1 below, the first principal component

(PC) has an eigenvalue of 1.955 and represents more than 65% of information in the combined educational constituents.

Table 1: Principal Component Analysis for educational index (Educatex)

	Component Loadings			Cumulative		
	PSE	SSE	TSE	Proportion	Proportion	Eigen value
First PC	0.443	0.659	0.607	0.651	0.651	1.955
Second PC	0.868	-0.147	-0.474	0.267	0.918	0.801
Third PC	-0.223	0.737	-0.638	0.081	1.000	0.243

PC: Principal Component. PSE: Primary School Enrolment. SSE: Secondary School Enrolment. TSE: Tertiary School Enrolment.

The index created via PCA is called *Educatex*, which is the measurement of lifelong learning. This indicator has been recently used by Asongu and Nwachukwu (2015a), Asongu and Nwachukwu (2016) in assessing the relationship between lifelong learning and governance. Consistent with the discussion in the introduction, *Educatex* is different from the two discussed lifelong learning macroeconomic indicators in at least two ways, notably, it focuses on: (i) developing countries and (ii) exclusively on the 'learning to know' dimension of the CLI and ELLI for Canada and European countries respectively.

We briefly devote some space to engaging the statistical relevance of the PC-derived lifelong learning measurement. In accordance with Asongu and Nwachukwu (2015ab, 2016), we engage the justification of PC-augmented indicators at two levels, namely: general and specific points. From a general perspective, Pagan (1984, p. 242) has provided an interesting analysis on concerns arising from regressors that are the outcome of some initial estimations. The issues raised are allied to the efficiency, validity and consistency of estimated parameters. According to the account, whereas two-step estimators are for the most part reliable, they provide only few valid inferences. These issues have been confirmed in contemporary studies, notably: Oxley and McAleer (1993), Ba and Ng (2006), McKenzie and McAleer (1997), and Westerlund and Urbain (2013a).

With respect to the specific point, we are using *Educatex* which is a PC-derived indicator. Concerns about PC indicators have been substantially engaged by Westerlund and Urbain (2012, 2013b) who have built on previous works (mentioned in the previous paragraph) and other related studies (Stock and Watson, 2002; Pesaran, 2006; Bai, 2009; Bai, 2003; Greenaway-McGrevy et al., 2012). These authors have advised that normal corollaries are possible with PC-factor loadings if corresponding estimated coefficients converge towards their true values at the rate of $\sqrt{NT}$ (where N represents cross-section observations and T denotes the number of time

series). In addition, Westerlund and Urbain (2012, 2013b) have argued that the underlying conditions for convergence (essential for good inferences of estimated parameters derived from PC factor loadings) are more feasible for a comparatively large sample. However, there is no mention of how large should be large. With respect to our sample, we are unable to increase N, because 53 of the 54 countries in the African continent have been sampled, with the exception of South Sudan for which data is not available before 2011. As concerns T, for which we have a starting year of 1996, Asongu and Nwachukwu (2015ab, 2006) have employed the PC-augmented factors using the same periodicity adopted by this line of inquiry.

2.2.2 Estimation technique

There is a threefold justification for the employment of a dynamic System Generalized Method of Moments (GMM) as an estimation strategy. First, it enables the control of endogeneity in the regressors because all are instrumented. Second, the potential small sample biases issues of the difference estimator are mitigated. Third, cross-country variations are not eliminated. Therefore, consistent with Bond et al. (2001), the System GMM procedure (Arellano & Bover, 1995; Blundell & Bond, 1998) has been chosen relative to the Difference estimator (Arellano & Bond, 1991). In the specification exercise, a *two-step* approach is preferred to the *one-step* method because it is accounts for heteroscedasticity. Moreover, we control for time fixed effects. In order to investigate the validity of the models, two tests are performed: the Arellano and Bond (AR(2)) test for the absence of autocorrelation in the residuals and the Sargan overidentifying restrictions (OIR) test for the validity of the instruments. Due to the concern of instrument proliferation, we have used three-year non-overlapping intervals (NOI). The three-year NOI are also essential for mitigating short-term (or business cycle disturbances). Above all, it ensures that the basic condition for the use of a GMM estimation procedure as estimation strategy: N>T (53>5).

In light of the above, the GMM equations in level and first difference are as follows:

$$Edu_{i,t} = \sigma_0 + \sigma_1 Edu_{i,t-1} + \sigma_2 T_{i,t} + \sigma_3 MD_{i,t} + \sigma_4 DAC_{i,t} + \sum_{j=1}^{4} \partial_j X_{i,t} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

$$Edu_{i,t} - Edu_{i,t-1} = \sigma_1(Edu_{i,t-1} - Edu_{i,t-2}) + \sigma_2(T_{i,t} - T_{i,t-1}) + \sigma_3(MD_{i,t} - MD_{i,t-1}) + \sigma_4(DAC_{i,t} - DAC_{i,t-1})$$
$$+ \sum_{j=1}^{4} \partial_j \left(X_{i,t} - X_{i,t-1} \right) + (\xi_t - \xi_{t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (2)$$

Where: 't' represents the period and 'i' stands for a country. *Edu* entails *PSE*, Primary School Enrolment; *SSE*, Secondary School Enrolment; *TSE*, Tertiary School Enrolment; *Educatex*, lifelong learning; *T* is total aid; *MD* is aid from multilateral donors; *DAC* is aid from DAC countries; *X* is the set of control variables (*Government expenditure*, *GDP growth, trade openness* and *inflation*); η_i is a country-specific effect; ξ_t is a time-specific constant and $\varepsilon_{i,t}$ is an error term. The estimation procedure consists of simultaneously estimating the regression in levels (Eq. [1]) with that in first-difference (Eq. [2]), thereby exploiting all the orthogonality or parallel conditions between the lagged endogenous variable and error term.

We devote more space to articulating how potentially exogenous covariates are handled by the estimated technique. For example government expenditure may be viewed as being treated as exogenous, in spite of knowledge that a key issue in foreign aid is the substitution between government expenditure and foreign aid. The potentially endogenous nature of government expenditure is addressed by specificities of the estimation technique, since lagged levels of government expenditure are used as instruments in the difference equation and lagged differences of government expenditure used as instruments in the level equation. This contributes to the exploitation of all orthogonality conditions between the lagged dependent variable and errors terms in order to ultimately address the concern of endogeneity.

3. Empirical results

This section assesses three main issues, notably, the: notably: (i) the effect of aid on education; (ii) the incremental impact of aid on education and (iii) the effect of aid on lifelong learning. To address these issues, we investigate the impacts of foreign aid on the three educational variables and one lifelong learning indicator. In this light, comparing the impact of the first-three schooling indicators is essential to fully appreciate the effect on the lifelong learning indicator. While Table 2 represents the main assessment with Total NODA, Table 3 has been employed for sensitivity analysis in order to further investigate the effects of NODA from the Development Assistance Committee (Panel A) and Multilateral Donors (Panel B). Irrespective of tables, but for a few exceptions, the models are overwhelmingly valid based on the

information criteria highlighted in the preceding section. Accordingly, for the most part, the null hypotheses of the Sargan OIR and AR(2) tests are not rejected[2].

Based on the evidence in Table 2 below, the following are established. First, total aid increases only primary schooling and lifelong learning, with the magnitude of the former significantly higher. Second, effects on secondary and tertiary school enrolments are not significant. Third, although some of the control variables are insignificant, they nonetheless overwhelmingly have the expected signs.

Table 2: The effect of foreign aid on lifelong learning

	Dependent variable: Education							
	Primary Schooling		Secondary Schooling		Tertiary Schooling		Lifelong Schooling (Educatex)	
Education (-1)	**0.925***	**1.227***	**0.923***	**1.047***	**1.230***	**1.153***	**1.105***	**1.139***
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Constant	8.413	-17.746	5.028	1.510	-0.633	-0.876	**0.191****	0.199
	(0.699)	(0.153)	(0.122)	(0.484)	(0.231)	(0.402)	**(0.026)**	(0.130)
NODA (Total)	0.289	**0.781***	-0.098	0.119	0.024	0.058	**0.008***	**0.014***
	(0.255)	**(0.000)**	(0.281)	(0.300)	(0.317)	(0.445)	**(0.087)**	**(0.098)**
Gov. Expenditure	---	0.092	---	-0.008	---	0.057	---	0.006
		(0.408)		(0.918)		(0.113)		(0.268)
GDP growth	---	0.360	---	0.180	---	-0.021	---	0.005
		(0.193)		(0.505)		(0.587)		(0.291)
Trade	---	-0.045	---	-0.022	---	0.006	---	**-0.001****
		(0.315)		(0.105)		(0.514)		**(0.036)**
Inflation	---	-0.076	---	-0.156	---	-0.067	---	-0.001
		(0.819)		(0.428)		(0.223)		(0.853)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	**(0.152)**	**(0.158)**	**(0.284)**	**(0.846)**	**(0.813)**	**(0.597)**	**(0.180)**	**(0.131)**
Sargan OIR	(0.036)	**(0.134)**	**(0.290)**	(0.089)	**(0.422)**	**(0.329)**	**(0.795)**	**(0.638)**
Wald (joint)	**24.671***	**100.43***	**1604.5***	**3761***	**594.85***	**385.57***	**269.73***	**402.35***
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Instruments	14	18	14	18	14	18	14	18
Countries	64	33	40	28	33	25	29	22
Observations	174	113	134	87	112	80	87	61

***, **, and * indicate significance at 1%, 5% and 10% levels respectively. AR(2): Second Order Autocorrelation test. OIR: Overidentifying Restrictions test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(2) tests and; b) the validity of the instruments in the Sargan OIR test. P-values in bracket. Gov: Government. NODA: Total Net Official Development Assistance.

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[2] It is important to note that, in order to assess the validity of the models, two tests have been performed, notably: the Arellano and Bond autocorrelation test that examines the null hypothesis of no autocorrelation and the Sargan-test which investigates the over-identification restrictions. The latter test examines whether instruments are not correlated with the error term in the main equation. The null hypothesis of this test is the position that the instruments as a group exhibit strict exogeneity or do not suffer from endogeneity. We have only reported AR(2) in difference because it is more relevant than the AR(1) which detects autocorrelation in levels. For the most part, we have neither rejected the Sargan null hypothesis for the validity of the instruments nor the AR(2) null for the absence of autocorrelation.

Table 3: Sensitivity analysis with foreign aid from DAC countries and Multilateral Donors

Dependent variable: Education
Panel A: Foreign Aid from the Development Assistance Committee (DAC) Countries

	Primary Schooling		Secondary Schooling		Tertiary Schooling		Lifelong Schooling (Educatex)	
Education (-1)	**0.736***	**1.202***	**0.932***	**1.057***	**1.229***	**1.150***	**1.110***	**1.140***
	(0.058)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Constant	25.190	-15.936	4.565	1.361	-0.661	-0.955	**0.211****	0.181
	(0.480)	(0.196)	(0.140)	(0.583)	(0.212)	(0.309)	**(0.020)**	(0.240)
NODADAC	0.254	**1.172****	-0.143	0.174	0.048	0.104	0.012	**0.024***
	(0.591)	**(0.024)**	(0.314)	(0.420)	(0.261)	(0.263)	(0.160)	**(0.054)**
Gov. Expenditure	---	0.120	---	-0.001	---	**0.060***	---	0.007
		(0.286)		(0.989)		**(0.084)**		(0.193)
GDP growth	---	0.399	---	0.189	---	-0.025	---	0.005
		(0.162)		(0.472)		(0.471)		(0.290)
Trade	---	-0.037	---	**-0.023***	---	0.007	---	-0.001
		(0.385)		**(0.097)**		(0.460)		(0.154)
Inflation	---	0.006	---	-0.150	---	-0.069	---	-0.001
		(0.983)		(0.457)		(0.257)		(0.860)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	**(0.279)**	**(0.158)**	**(0.263)**	**(0.851)**	**(0.817)**	**(0.598)**	**(0.188)**	**(0.132)**
Sargan OIR	**(0.101)**	**(0.126)**	**(0.265)**	(0.091)	**(0.432)**	**(0.301)**	**(0.807)**	**(0.599)**
Wald (joint)	**6.036***	**106.63***	**933.97***	**3043***	**814.45***	**583.33***	**214.04***	**470.44***
	(0.048)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Instruments	14	18	14	18	14	18	14	18
Countries	46	33	40	27	33	25	29	22
Observations	174	113	134	87	112	80	87	61

Panel B: Foreign Aid from Multilateral Donors

	Primary Schooling		Secondary Schooling		Tertiary Schooling		Lifelong Schooling (Educatex)	
Education (-1)	**0.886***	**1.235***	**0.909***	**1.036***	**1.230***	**1.155***	**1.100***	**1.126***
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Constant	11.985	-15.450	**5.529***	2.010	-0.548	-0.366	**0.198****	**0.277****
	(0.584)	(0.248)	**(0.099)**	(0.266)	(0.238)	(0.649)	**(0.014)**	**(0.011)**
NODAMD	0.678	**1.335****	-0.221	0.262	0.039	0.029	**0.017***	0.020
	(0.200)	**(0.029)**	(0.264)	(0.229)	(0.394)	(0.850)	**(0.056)**	(0.292)
Gov. Expenditure	---	0.062	---	-0.024	---	0.054	---	0.004
		(0.620)		(0.745)		(0.153)		(0.486)
GDP growth	---	0.414	---	0.174	---	-0.008	---	0.007
		(0.156)		(0.511)		(0.826)		(0.119)
Trade	---	-0.065	---	-0.023	---	0.003	---	**-0.001***
		(0.175)		(0.125)		(0.756)		**(0.004)**
Inflation	---	0.007	---	-0.154	---	-0.049	---	0.0004
		(0.980)		(0.437)		(0.349)		(0.948)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	**(0.158)**	**(0.133)**	**(0.290)**	**(0.848)**	**(0.814)**	**(0.603)**	**(0.178)**	**(0.142)**
Sargan OIR	(0.020)	(0.072)	**(0.336)**	**(0.087)**	**(0.415)**	**(0.385)**	**(0.765)**	**(0.643)**
Wald (joint)	**17.311***	**85.511***	**1911.8***	**3607***	**430.66***	**283.66***	**310.96***	**323.54***
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Instruments	14	18	14	18	14	18	14	18
Countries	46	33	40	28	33	25	27	22
Observations	174	113	134	87	112	80	87	61

***, **, and * indicate significance at 1%, 5% and 10% levels respectively. AR(2): Second Order Autocorrelation test. OIR: Overidentifying Restrictions test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(2) tests and; b) the validity of the instruments in the Sargan OIR test. P-values in bracket. Gov: Government. NODADAC: Net Official Development Assistance from the Development Assistance Committee. NODAMD: Net Official Development Assistance from Multilateral Donors.

In order to investigate the robustness of findings in Table 2, we engage some sensitivity analysis using alternative measures of NODA, namely: NODA from the Development Assistance Committee (DAC) countries and NODA from Multilateral Donors (MD). While Panel A of Table 3 shows results from NODADAC, the findings of NODAMD are provided in Panel B. The estimates of lifelong learning and its constituent components are broadly consistent with those of Table 2, with the exception of aid from MD which positively affects only lifelong learning because the Sargan OIR is significant in the 'primary school'- related regressions. The control variables also have the expected signs.

The overwhelmingly positive effect of primary education is consistent with Asiedu (2014) and could be partly elucidated by the fact that primary schooling entails higher social returns relative to other educational levels when economies are at initial stages of development. This elucidation is broadly in line with Petrakis and Stamatakis (2002) and Asiedu (2014). Moreover, it is interesting to note that the findings on lifelong learning do not validate the conclusions from Preece (2013) on the position that international aid priorities have negative effects on government policies and choices for lifelong learning.

In light of the paradigm on 'soft economics' from Kuada (2015) and associated studies[3] engaged in the introduction, inclusive growth in Africa can be sustained by channeling foreign aid through mechanisms of education and lifelong learning. This inference is consistent with the recent evidence that foreign aid is positive to economic growth (Kargbo & Sen, 2014; Gyimah-Brempong & Racine, 2014) and the impact is more apparent when development assistance is channeled through educational mechanisms (Asiedu & Nandwa, 2007; Asiedu, 2014).

As Fields (2015) has shown, labour market supply side (low skills) deficiencies that are strongly associated with the welfare of African countries can be addressed by channeling foreign aid effectively to the improvement of learning and acquisition of skills. Moreover, there is a longstanding issue of education being hampered in Africa by missing inputs like textbooks and other material (Filmer & Pritchett, 1997). This is consistent with recent evidence of depleting knowledge infrastructure, brain-drain, outdated curricula and limited direct linkages between science and technology (Tchamyou, 2015; Asongu, 2015g). Moreover, the continent has been experiencing a downward trend in KE (Anyanwu, 2012). Kamara et al. (2007) have suggested

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[3] Please see: Simpasa et al. (2015), Page and Shimeles (2015), Jones et al. (2015), Asongu (2015f), Jones and Tarp (2015) and Page and Söderbom (2015).

that unless bold measures are put in place to reinvigorate technology and science, higher education and innovation, Africa may miss development opportunities and positive externalities associated with knowledge-based-economies. Based on our findings, foreign aid can be used to reinvigorate the elements suggested by Kamara et al. in at least three main dimensions.

First, development assistance can be used to increase the ratio of research and development (R&D) on GDP. Education would consolidate the country's ability to acquire new knowledge and technology needed for the drive towards KE. Development assistance could also be tailored towards efforts of enhancing core human resource development as well as indigenous R&D platforms that are essential for consolidating technological blocks and imparting knowledge in societies. Consistent with Tchamyou (2015), practical and disciplinary factors by citizens are important in achieving these educational strategies. Hence, as supported by Lee (2009), foreign aid would have to be tailored in conjunction with considerable improvements in the quality of institutions in recipients countries, including the autonomy and capacity of local governments implementing the 'foreign aid'-oriented schemes.

Second, given the constantly changing technological environments, in order for workers to adapt to changing conditions of technology, foreign aid should also be devoted towards enhancing vocational and technical trainings, as well as encouraging trainings at work places. This recommendation is based on the fact that as African countries develop, technological competence would be a critical component in the quality of its human resources, in tacit as well as specialized knowledge. Moreover, for these initiatives to work, when formulated, their implementation would require foreign assistance policies to favor the nurturing of high-caliber scientists and engineers that are capable of facing and handling challenges in the frontiers of science and technology. As suggested by Tchamyou (2015) and Asongu (2015h), it would be relevant to complement education and industrialization for KE. Hence foreign aid policies could be tailored towards encouraging sustainable development by ensuring that: (i) education results in industrialization and technological learning and (ii) industrialization increases the rate of investment in education which further increases the demand for education.

Third, on the linkage between education and innovation, foreign aid policies could be adjusted to facilitate reversed engineering because the know-how of academic institutions in Africa is currently more imitative and adaptive in nature (Asongu, 2014d, p. 579). This strategy which is consistent with Bezmen and Depken (2004) has very relevant practical implications

because South Korea achieved its economic miracle by copying technology-intensive commodities from more advanced countries (Kim et al., 2012; Kim, 1997; Kim & Kim, 2014). It follows that foreign aid policies could facilitate less stringent property rights needed for informal transfer of technology, reverse engineering and mastery of technology-intensive commodities by African countries because they are at the initial stage of industrialization. This narrative is consistent with recent African KE studies which have concluded that less stringent intellectual property rights (IPRs) could reduce poverty (Asongu, 2014e) and boost scientific publications (Asongu, 2014d) on the continent. It follows that the use of foreign aid to encourage lifelong learning strategies in recipient countries augurs well with the ultimate goal of increasing living standards and human development.

It is also important to noted that whereas the policy recommendations partly build on Kim et al. (2012) in arguing for foreign aid to favor less stringent property rights, the implications do not engage the debate over whether less or more stringent IPRs are needed. What we seek to articulate in the recommendations is that alternative forms of IPRs such as utility models (or patents) could promote education for adaptive and minor innovations. This implication is in accordance with Kim (1997, p. 220) in the perspective that, it is exceedingly difficult for countries in the Third World to become industrialized by tailoring academic policies towards developing technological innovations. In essence, since huge investments in R&D are associated with the underlying scheme, the available R&D budget would be more optimally used for adaptive innovations.

4. Conclusion and future directions

This study has investigated the effect of foreign aid on education and lifelong learning in 53 African countries for the period 1996-2010. Three main issues have been assessed, notably: (i) the effect of aid on education; (ii) the incremental impact of aid on education and (iii) the effect of aid on lifelong learning. Lifelong learning has been measured as the combined knowledge acquired during the primary, secondary and tertiary levels of education. The empirical evidence is based on an endogeneity-robust Generalized Method of Moments. The following findings have been established. First, the aid variables have positive effects on primary school enrolment and lifelong learning, with the exception of aid from MD which positively affects only lifelong learning. Second, the positive effect on primary school enrolment consistently has a higher

magnitude compared to the impact on lifelong learning. Third, the effects of aid dynamics on secondary and tertiary school enrolments are not significant. We have also contributed to the literature by proposing a lifelong learning indicator for developing countries.

It is important to bear in mind that, the indicator of lifelong learning used in this study fails to capture ethical and moral conscientious learning that are linked with foreign aid. Furthermore, without a doubt, lifelong learning does not stop with schooling because practical realities of life are equally educative, especially in the first few years of work. Thus, the working environment also plays into how foreign aid potentially affects lifelong learning. Unfortunately, as we have justified in the introduction, we have limited the indicator of lifelong learning to schooling because of data availability constraints. Hence, future research could incorporate highlighted post-schooling factors in order to advance scholarship in the established relationships. In the same vein, other schooling indicators like standardized tests, dropout rates and repetition rates could also be considered. Future lines of inquiry devoted to improving the extant of knowledge on the established nexuses could focus on country-specific studies to enable more targeted policy implications. Furthermore, future research could also incorporate more dimensions of heterogeneity in foreign aid as emphasized by Asiedu and Nandwa (2007). Within this framework, focusing on different aid components or sectors (like education) is worthwhile.

Appendices

Appendix 1: Definitions of variables

Variable(s)	Definition(s)	Source(s)
Aid1: NODA (Total)	Total Net Official Development Assistance (% of GDP)	World Bank (WDI)
Aid 2: NODADAC	Net Official Development Assistance for the Development Assistance Committee (% of GDP)	World Bank (WDI)
Aid 3: NODAMD	Net Official Development Assistance from Multilateral Donors (% of GDP)	World Bank (WDI)
Primary Schooling (PS)	Primary School Enrolment (% of Gross)	World Bank (WDI)
Secondary Schooling (SS)	Secondary School Enrolment (% of Gross)	World Bank (WDI)
Tertiary Schooling (TS)	Tertiary School Enrolment (% of Gross)	World Bank (WDI)
Educational index	First principal component of PS, SS & TS	PCA
GDP growth	Gross Domestic Product growth rate (annual %)	World Bank (WDI)
Trade Openness	Exports plus Imports of Commodities (% of GDP)	World Bank (WDI)
Government Expenditure	Government Final Consumption Expenditure(% of GDP)	World Bank (WDI)
Inflation	Consumer Price Index (annual %)	World Bank (WDI)

WDI: World Bank Development Indicators. GDP: Gross Domestic Product. PCA: Principal Component Analysis. NODA: Net Official Development Assistance. NODADAC: NODA from the Development Assistance Committee (DAC) countries. NODAMD: NODA from Multilateral Donors.

Appendix 2: Summary statistics

	Mean	S.D	Min	Max	Obs.
Total Net Official Development Assistance	10.889	12.029	0.015	102.97	253
NODA from DAC countries	6.278	7.303	-0.003	68.063	253
NODA from Multilateral Donors	4.525	5.083	0.004	33.249	253
Primary School Enrolment	94.414	25.647	28.298	149.70	237
Secondary School Enrolment	38.683	26.489	5.372	115.03	199
Tertiary School Enrolment	6.228	8.489	0.241	53.867	183
Educational index	-0.070	1.327	-2.103	5.527	152
GDP growth	4.755	5.587	-11.272	49.367	254
Trade Openness	78.340	39.979	20.980	250.95	247
Government Expenditure	4.495	8.064	-17.387	49.275	164
Inflation	56.191	575.70	-45.335	8603.3	230

S.D: Standard Deviation. Min: Minimum. Max: Maximum. Obs: Observations. NODA: Net Official Development Assistance. DAC: Development Assistance Committee.

Appendix 3: Correlation Analysis

GDPg	Trade	Gov.E	Inflation	Aid1	Aid2	Aid3	PSE	SSE	TSE	Educatex	
1.000	0.179	0.254	-0.132	0.114	0.109	0.111	0.095	-0.078	-0.036	-0.006	GDPg
	1.000	-0.070	0.024	-0.083	-0.061	-0.114	0.261	0.389	0.057	0.283	Trade
		1.000	-0.243	0.078	0.077	0.060	0.019	0.013	0.092	0.087	Gov.E
			1.000	-0.023	-0.011	-0.035	-0.064	-0.100	-0.081	-0.106	Inflation
				1.000	0.975	0.946	-0.055	-0.488	-0.454	-0.456	Aid1
					1.000	0.854	-0.064	-0.449	-0.440	-0.452	Aid2
						1.000	-0.026	-0.481	-0.422	-0.409	Aid3
							1.000	0.452	0.257	-0.635	PSE
								1.000	0.725	0.919	SSE
									1.000	0.843	TSE
										1.000	Educatex

GDPg: GDP growth rate. Gov. E: Government Expenditure. Aid1: Total Net Official Development Assistance (NODA). Aid2: NODA from the DAC countries. Aid3: NODA from Multilateral Donors. PSE: Primary School Enrolment. SSE: Secondary School Enrolment. TSE: Tertiary School Enrolment. Educatex: educational index.

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