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Foreign aid volatility and lifelong learning: demand-side empirics to a textual literature

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Foreign aid volatility and lifelong learning: demand-side empirics to a textual literature

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Abstract

Purpose- This paper has put a demand-side empirical structure to the hypothesis that foreign aid volatility adversely affects choices to lifelong learning in recipient countries

Design/methodology/approach- Lifelong learning is measured as the combined knowledge acquired during primary, secondary and tertiary educational enrolments. Three types of aggregate foreign aid volatilities are computed in a twofold manner: baseline standard deviations and standard errors (standard deviations of residuals after first-order autoregressive processes). An endogeneity robust dynamic system GMM empirical strategy is employed.

Findings- The findings broadly show that foreign aid volatility does not adversely affect the demand-side choices of lifelong learning in Africa.

Practical implications- As a policy implication, when faced with aid uncertainty, the demand for education would increase. This may be explained by the need for more self-reliance in order to mitigate income risks or/and the use of education as means of copping with uncertainty. Moreover, the findings indirectly confirm a stream of the literature sustaining that when faced with uncertainty in external financial flows, countries may recourse to promoting human resource development through lifelong learning and knowledge economy as a competitive advantage. This may also explain why countries which have acknowledged scarcity in external financial flows from natural resources have done relatively better compared to their natural resource-rich counterparts.

Originality/value- This paper has provided demand-side empirics to a hypothesis that could substantial influence policy making.

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

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1. Introduction

While recent evidence from the literature confirm the positive effects of foreign aid on economic growth (Gyimah-Brempong and Racine, 2014; Kargbo and Sen, 2014), there is a growing stream of studies consistently questioning the effectiveness of development assistance (Banuri, 2013; Ghosh, 2013; Krause, 2013; Marglin, 2013; Monni and Spaventa, 2013; Titumir and Kamal, 2013; Wamboye et al., 2013; Quartey and Afful-Mensah, 2014; Asongu, 2014a, 2015ab). According to Amin (2014), neo-colonialism has been the main motivating factor behind foreign aid in developing countries. Quartey and Afful-Mensah (2014) have concluded that African countries need to relinquish their overly reliance on development assistance and look for alternative sources of finance. The positions of Amin, Quartey and Afful-Mensah are consistent with Ndlovu-Gatsheni (2013) on Africa's entrapment in neo-colonial foreign aid webs of influence and Kindiki (2011) who has admonished African nations to strategically limit their dependence on international aid systems. Obeng-Odoom (2013) recommends that policies governing foreign aid should be based on the fundamental needs of citizens in recipient countries. A view confirmed by Arthur and Quartey (2008) on the imperative for a holistic approach that integrates all stakeholders in an international policy of migration management based on foreign aid.

The fall of the Berlin wall, the global financial crises, economic issues in donor countries and geopolitical interest (inter alia) have substantially affected the proportion of budget allocated to developing countries by developed nations. This note puts an empirical structure to the textual analysis of Preece (2013) which could seriously influence debates in policy making and academic circles. The underlying paper has concluded: "*This paper discusses the relationship between international agendas for lilfelong learning and financial aid for low income countries, especially those on the African continent. It argues that there are subtle differences in*

terminology written by policymakers respectively in Europe and South Africa for lifelong learning but that international development agendas reinscribe lifelong learning for countries in receipt of development aid. Taking a postcolonial perspective the paper provides a textual analysis of case examples from policy documents in two African countries to demonstrate how international aid priorities negatively affect government choices and policies for lifelong learning, in spite of more regional analyses of the role of education and lifelong learning for the continent's development needs. It argues that the inclusion of indigenous worldviews from the south have potential to enhance a global agenda for the social purpose element of lifelong learning" (Preece, 2013, p. 98). The interest of this study is to investigate the Preece findings in light of demand-side choices of lifelong learning. Hence the investigated hypothesis is as follows: foreign aid volatility adversely affects demand-side choices of lifelong learning in Africa.

This study assesses the hypothesis in three main steps. First, we define the multidimensional and complex phenomenon of lifelong learning as the combined knowledge acquired during primary, secondary and tertiary education. Hence, we employ principal component analysis to obtain a composite indictor for the measurement. Second, we assess the effects of foreign aid and foreign aid volatility on all educational indicators under consideration. Third, we compare the impacts of foreign aid with those on foreign aid volatility to assess differences in magnitudes and signs in order to either validate or reject the hypothesis.

We briefly engage some literature that is positioned along the same line of inquiry. Johnson and Quartey (2009) have investigated the effect of foreign aid on human development and welfare indicators to conclude that while bilateral aid does not significantly affect the underlying indicators, when aid is disaggregated into sector-specific programs, there is some significant impact on human development. This tendency of appealing findings on human development after disaggregating foreign aid is consistent with the Asongu (2014b) clarification

of the questionable economics of development assistance in African countries advanced by Asongu (2014c). Asiedu and Nandwa (2007) have examined whether development assistance in education significantly affects growth to conclude that the effect of foreign aid is contingent on income-levels and the aid categories. Asiedu (2014) has extended Asiedu and Nandwa (2007) to establish that the effect of foreign aid further depends on the primary and post-primary education. The findings from Asiedu and Nandwa are consistent with Johnson, Quartey and Asongu on the need for incorporating heterogeneity when investigating the effects of development assistance.

The rest of the study is organized as follows. We discuss the data and methodology in Section 2. Section 3 covers the empirical analysis and discussion of results. Section 4 concludes.

2. Data and Methodology

2.1 Data

We investigate a sample of 53 African countries with annual data from World Development Indicators for the period 1996-2010. The periodicity begins from 1996 because of the interest of obtaining results with updated and more focused implications. The choice of Africa as scope of the study is consistent with the underlying study which is focused on countries in the continent. The dependent variable of lifelong learning is measured using principal component analysis (PCA). Accordingly, it is the first principal component of primary, secondary and tertiary school enrolment levels. For more subtlety in the analysis, we complement the dependent variable of interest with its constituent indicators. The intuition for this subtlety is that, in order to fully appreciate the effect on lifelong learning, the independent effects on various enrolment levels (constituting the lifelong learning variable) have to be assessed. In essence, some comparative perspective is needed to fully investigate the underpinning hypothesis. The PCA

method used to measure the lifelong learning composite indicator is discussed in Section 2.2.1 below.

The principal independent variable of interest is net official development assistance (NODA) to which NODA from the Development Assistance Committee (DAC) countries and NODA from Multilateral Donors, are added for robustness purposes. Two measurements of volatility are employed: (1) a baseline 3 year non-overlapping intervals (NOI) simple standard deviations and; (2) an augmented measurement of volatility with standard errors or standard deviations of residuals saved after first-order autoregressive processes. The latter measurement is consistent with Kangoye (2013).

There is a fourfold justification for the use of three-year non-overlapping intervals (NOI). First, data averages reduce business cycle or short-term disturbances that may substantially loom. Second, the averages also ensure that the primary conditions for the employment of Generalized Methods of Moments (GMM) are met (N>T: 53>5). Third, three-year NOI limit instrument proliferation or restrict overidentification by ensuring that the number of instruments are less than the number of cross-sections. Fourth, there is a loss of one degree of freedom after the computation of residuals in the first-order autoregressive procedure and a minimum of two periods are essential for the computation of the corresponding standard deviations of the residuals to obtain standard errors.

In accordance with Andrés et al. (2014), we control for inflation, trade openness, economic prosperity and government expenditure. Whereas we expect GDP growth, trade openness and government expenditure to affect lifelong learning in a positive manner, inflation could have the opposite effect. In essence, if expenditure from government that is meant to promote lifelong learning is not tainted by corrupt practices and management inefficiency, it should have a positive effect on education. From the South Korean experience, we expect trade

openness and economic prosperity to be conducive for learning (Asongu, 2014d). Inflation could substantially mitigate expectations in educational return and therefore, reduce long-run investment in education oriented projects.

The correlation analysis, summary statistics and definition of variables are presented in Appendix 3, Appendix 2 and Appendix 1 respectively. From the descriptive statistics, we can see that the indicators are quite comparable and given the significant variations displayed, we can also be confident that reasonable estimated relationships would emerge. The purpose of the correlation matrix is the mitigate multicollinearity and over parameterization concerns that potentially exist among NODA variables.

2.2 Methodology

2.2.1 Principal component analysis

Given the complex and multidimensional character of lifelong learning, we measure it as the combined knowledge acquired in primary, secondary and tertiary schools. This is essentially because, whereas lifelong learning entails a process from birth to death, it can most objectively be measured only as the process of learning in formal education. We measure the phenomenon by using principal component analysis (PCA). PCA is a widely employed technique that is used to extract common information among a highly correlated set of variables. It consists of reducing the dimensions of highly correlated indicators into a few uncorrelated dimensions called principal components (PCs) that reflect specific information. Therefore lifelong learning is measured as the first PC. In the choice of which PC to be retained, the Kaiser (1974) and Jolliffe (2002) criterion is employed to choose the common factor or information contained in the three educational levels. They have recommended retaining only PCs that have an eigenvalue greater than the mean or one. As shown in Table 1 below, the first PC has an eigenvalue of 1.955 with more than 65%

of the combined information in primary, secondary and tertiary educations. From intuition this could be attributed to the number of students that study from the primary school through the tertiary level. Hence, consistent with Asongu and Nwachukwu (2016), our new lifelong learning indicator is the composite index (*Educatex*).

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.

2.2.2 Estimation technique

We employ the dynamic *system* GMM estimation approach because of three main reasons: first, it does not eliminate cross-country regressions; second, it corrects small sample biases of the difference estimator and; it controls for endogeneity in all the regressors. It is specifically for the second reason that we are in line with Bond et al. (2001, pp. 3-4) in preferring the *system* GMM approach (Arellano and Bover, 1995; Blundell and Bond, 1998) to the *difference* estimator (Arellano & Bond, 1991). In specifying the equations, a *two-step* procedure that is heteroscedasticity-consistent is also preferred to the *one-step* approach because the former is homoscedasticity-consistent. We perform two tests to assess the validity of the models: the Sargan over-identifying restrictions (OIR) test for instrument validity and; the Arellano & Bond autocorrelation (AR(2)) test for the absence of autocorrelation in the residuals. The motivations for employing data averages (or 3 year NOI) have already been critically and exhaustively engaged in the data section.

The following equations in levels and first differences define the adopted GMM strategy.

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

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

Where: 't' represents the period and 'i' denotes a country. *Edu* is Education which constitutes, primary, secondary and tertiary schools as well as their composite index of lifelong learning ; T, Total NODA; DAC, NODA from DAC countries; MD, NODA from Multilateral Donors; X is the set of control variables (*Government expenditure, GDP growth, Trade openness* & *Inflation*); η_i is a country-specific effect; ξ_t is a time-specific constant and; $\varepsilon_{i,t}$ an error term. The estimation process entails jointly estimating the equations in levels (Eq. (1)) with those in first-difference (Eq. (2)), in order to exploit all the parallel or orthogonality conditions between the error term and the lagged endogenous variable.

3. Empirical results

The section assesses two main concerns: the effects of foreign aid on the four educational indicators and the effects of foreign aid volatility on the dependent variables. In essence, it is relevant to compare the independent incidences on the first-three school measurements in order to fully appreciate the impact on the lifelong learning measurement. Section 3.1 presents distortions as standard deviations of three-year NOI whereas Section 3.2 uses standard errors as a measurement of volatility. We notice consistently across the tables in the sections that, but for a few exceptions (in primary and secondary educational models) where the null hypothesis of the Sargan OIR is rejected, the models are overwhelmingly valid. This is essentially because the null hypotheses of the AR(2) and Sargan OIR tests are rejected for the most part[2]. It is also important

As an important note, in order to examine the validity of the models, we have performed two tests, notably: the Arellano and Bond autocorrelation test that assesses the null hypothesis of no autocorrelation and the Sargan-test that examines the over-identification restrictions. The latter test investigates if the instruments are not correlated with the error terms. The null hypothesis of this test is the stance that the instruments as a group are strictly exogenous. While the null hypothesis of the AR(2) is overwhelmingly rejected, the null of Sargan is not rejected in some cases of primary and secondary school enrolment modeling.

to note that invalidity of some primary and secondary school specifications does not affect the main problem statement of the study which is the assess the effects of aid volatility on lifelong learning.

3.1 Volatility as standard deviations

Table 2 below investigates the effects foreign aid on the educational variables. It can be noticed that while foreign aid positively impacts primary school enrolment and lifelong learning, foreign aid volatility does not significantly affect lifelong learning. Hence, a decision cannot be drawn because foreign aid does not significantly affect lifelong learning. Most of the significant control variables (*GDP growth* and *government expenditure*) have the expected signs. The negative effect of trade on education can be explained from the perspective that, trade openness might provide 'school drop-out' incentives to engage in business activity (related to import or exports).

Table 2: The effects of foreign aid on lifelong learning

	Dependent variable: Education							
	Primary Schooling		**Secondary Schooling**		**Tertiary Schooling**		**Lifelong Schooling (Educatex)**	
Education (-1)	**1.227*** **	**1.170*** **	**1.047*** **	**1.058*** **	**1.153*** **	**1.175*** **	**1.139*** **	**1.120*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Constant	-17.746	-9.984	1.510	2.270	-0.876	-0.629	0.199	**0.310** **
	(0.153)	(0.516)	(0.484)	(0.229)	(0.402)	(0.287)	(0.130)	**(0.026)**
NODA (Total)	**0.781*** **	---	0.119	---	0.058	---	**0.014***	---
	(0.000)		(0.300)		(0.445)		**(0.098)**	
NODASD1 (Total)	---	**0.763***	---	0.076	---	0.082	---	0.018
		(0.061)		(0.680)		(0.332)		(0.209)
Gov. Expenditure	0.092	0.191	-0.008	-0.019	0.057	**0.062** **	0.006	0.006
	(0.408)	(0.225)	(0.918)	(0.800)	(0.113)	**(0.023)**	(0.268)	(0.250)
GDP growth	0.360	**0.574** **	0.180	0.215	-0.021	0.002	0.005	**0.007** **
	(0.193)	**(0.029)**	(0.505)	(0.395)	(0.587)	(0.935)	(0.291)	**(0.043)**
Trade	-0.045	-0.058	-0.022	**-0.029***	0.006	0.003	**-0.001** **	**-0.001** **
	(0.315)	(0.214)	(0.105)	**(0.073)**	(0.514)	(0.682)	**(0.036)**	**(0.012)**
Inflation	-0.076	0.209	-0.156	-0.131	-0.067	-0.055	-0.001	0.001
	(0.819)	(0.350)	(0.428)	(0.527)	(0.223)	(0.352)	(0.853)	(0.844)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	**(0.158)**	**(0.138)**	**(0.846)**	**(0.866)**	**(0.597)**	**(0.554)**	**(0.131)**	**(0.199)**
Sargan OIR	**(0.134)**	(0.029)	(0.089)	(0.096)	**(0.329)**	**(0.408)**	**(0.638)**	**(0.703)**
Wald (joint)	**100.43*** **	**61.95*** **	**3761*** **	**1991.7*** **	**385.57*** **	**270.06*** **	**402.35*** **	**464.37*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Instruments	18	18	18	18	18	18	18	18

Countries	33	33	28	28	25	25	22	22
Observations	113	113	87	87	80	80	61	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. NODASD1 (Total): Total NODA volatility as Simple Standard Deviations.

Table 3: Robustness checks 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)	**1.202*** (0.000)**	**1.208*** (0.000)**	**1.057*** (0.000)**	**1.066*** (0.000)**	**1.150*** (0.000)**	**1.165*** (0.000)**	**1.140*** (0.000)**	**1.124*** (0.000)**
Constant	-15.936 (0.196)	-12.360 (0.357)	1.361 (0.583)	2.045 (0.317)	-0.955 (0.309)	-0.648 (0.211)	0.181 (0.240)	**0.291** (0.031)**
NODADAC	**1.172** (0.024)**	---	0.174 (0.420)	---	0.104 (0.263)	---	**0.024* (0.054)**	---
NODADACSD1	---	**1.198* (0.086)**	---	0.124 (0.661)	---	**0.141** (0.018)**	---	**0.027* (0.054)**
Gov. Expenditure	0.120 (0.286)	0.227 (0.232)	-0.001 (0.989)	-0.013 (0.871)	**0.060* (0.084)**	**0.068*** (0.003)**	0.007 (0.193)	0.007 (0.151)
GDP growth	0.399 (0.162)	**0.601** (0.038)**	0.189 (0.472)	0.226 (0.366)	-0.025 (0.471)	-0.0001 (0.995)	0.005 (0.290)	**0.008** (0.030)**
Trade	-0.037 (0.385)	-0.061 (0.171)	**-0.023* (0.097)**	**-0.030* (0.082)**	0.007 (0.460)	0.004 (0.604)	-0.001 (0.154)	**-0.001** (0.022)**
Inflation	0.006 (0.983)	0.141 (0.588)	-0.150 (0.457)	-0.145 (0.514)	-0.069 (0.257)	-0.069 (0.248)	-0.001 (0.860)	-0.0001 (0.984)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	**(0.158)**	**(0.161)**	**(0.851)**	**(0.899)**	**(0.598)**	**(0.569)**	**(0.132)**	**(0.159)**
Sargan OIR	**(0.126)**	(0.036)	(0.091)	(0.098)	**(0.301)**	**(0.358)**	**(0.599)**	**(0.721)**
Wald (joint)	**106.63*** (0.000)**	**75.797*** (0.000)**	**3043*** (0.000)**	**1659.7*** (0.000)**	**583.33*** (0.000)**	**259.88*** (0.000)**	**470.44*** (0.000)**	**543.66*** (0.000)**
Instruments	18	18	18	18	18	18	18	18
Countries	33	33	27	27	25	25	22	22
Observations	113	113	87	87	80	80	61	61

Panel B: Foreign Aid from Multilateral Donors

	Primary Schooling		**Secondary Schooling**		**Tertiary Schooling**		**Lifelong Schooling (Educatex)**	
Education (-1)	**1.235*** (0.000)**	**1.079*** (0.000)**	**1.036*** (0.000)**	**1.045*** (0.000)**	**1.155*** (0.000)**	**1.177*** (0.000)**	**1.126*** (0.000)**	**1.098*** (0.000)**
Constant	-15.450 (0.248)	-2.469 (0.901)	2.010 (0.266)	2.442 (0.184)	-0.366 (0.649)	-0.367 (0.565)	**0.277** (0.011)**	**0.323** (0.015)**
NODAMD	**1.335** (0.029)**	---	0.262 (0.229)	---	0.029 (0.850)	---	0.020 (0.292)	---
NODAMDSD1	---	0.967 (0.505)	---	0.235 (0.614)	---	-0.026 (0.888)	---	0.009 (0.811)
Gov. Expenditure	0.062 (0.620)	0.098 (0.368)	-0.024 (0.745)	-0.027 (0.715)	0.054 (0.153)	0.054 (0.120)	0.004 (0.486)	0.004 (0.480)
GDP growth	0.414 (0.156)	**0.512** (0.036)**	0.174 (0.511)	0.202 (0.440)	-0.008 (0.826)	-0.002 (0.934)	0.007 (0.119)	**0.008* (0.055)**
Trade	-0.065 (0.175)	-0.051 (0.329)	-0.023 (0.125)	**-0.027* (0.088)**	0.003 (0.756)	0.001 (0.843)	**-0.001*** (0.004)**	**-0.002** (0.019)**
Inflation	0.007 (0.980)	0.280 (0.184)	-0.154 (0.437)	-0.123 (0.522)	-0.049 (0.349)	-0.036 (0.529)	0.0004 (0.948)	0.002 (0.723)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

AR(2)	**(0.133)**	**(0.120)**	**(0.848)**	**(0.859)**	**(0.603)**	**(0.548)**	**(0.142)**	**(0.168)**
Sargan OIR	(0.072)	(0.022)	(0.087)	(0.093)	**(0.385)**	**(0.453)**	**(0.643)**	**(0.634)**
Wald (joint)	**85.511*** **	**71.22*** **	**3607*** **	**3083.8*** **	**283.66*** **	**335.76*** **	**323.54*** **	**305.44*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Instruments	18	18	18	18	18	18	18	18
Countries	33	33	28	28	25	25	22	22
Observations	113	113	87	87	80	80	61	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. NODADACSD1: NODADAC volatility as Simple Standard Deviations. NODAMDSD1: NODAMD volatility as Standard Deviations of the Residuals after first-order autoregressive processes.

The findings of Table 3 above (especially those of Panel A on foreign aid from DAC countries) are broadly consistent with those of Table 2 with the following exceptions. First, from Panel A two results merit emphasis. A higher magnitude in the effect of foreign aid volatility rejects the investigated hypothesis. With regard to Panel B on foreign aid from Multilateral Donors, the insignificant effects of the volatility neither validate not invalidate the hypothesis. Most of the significant control variables (*GDP growth* and *government expenditure*) also have the expected signs.

3.2 Sensitivity analysis with volatility as standard errors

In order to robustly verify the findings of Tables 2-3 above, we perform a sensitivity analysis using standard errors (instead of baseline standard deviations) as measurements of the volatilities. The standard errors are standard deviations of residuals obtained from the first-order autoregressive processes of the foreign aid dynamics. While Table 4 is based on Total NODA, Table 5 is focused on NODA from DAC countries (Panel A) and Multilateral Donors (Panel B).

The findings of Table 4 below reject the underlying hypothesis because of the higher magnitude in the effect of foreign aid volatilities to lifelong learning relative to the impact of foreign aid on the dependent variable. The results from Table 5 are a little ambiguous in Panel A. The hypothesis is not rejected in the lifelong learning regressions (owing to a lower positive

magnitude in foreign aid volatilities relative to the foreign aid magnitude). However, there is a positive effect of the aid volatilities on tertiary school enrolment and a corresponding insignificant effect of foreign aid on the tertiary educational dependent variable. In Panel B, we cannot conclude due to the insignificant effects.

The results of Tables 4-5, do not enable us to absolutely reject or confirm the investigated hypothesis. Most of the significant control variables have the expected signs.

Table 4: The effects of foreign aid on lifelong learning

	Dependent variable: Education							
	Primary Schooling		**Secondary Schooling**		**Tertiary Schooling**		**Lifelong (Educatex)**	**Schooling**
Education (-1)	**1.227*** (0.000)**	**1.152*** (0.000)**	**1.047*** (0.000)**	**1.065*** (0.000)**	**1.153*** (0.000)**	**1.171*** (0.000)**	**1.139*** (0.000)**	**1.128*** (0.000)**
Constant	-17.746 (0.153)	-7.945 (0.645)	1.510 (0.484)	2.127 (0.283)	-0.876 (0.402)	-0.635 (0.262)	0.199 (0.130)	**0.305** (0.019)**
NODA (Total)	**0.781*** (0.000)**	---	0.119 (0.300)	---	0.058 (0.445)	---	**0.014* (0.098)**	---
NODA SD2 (Total)	---	0.434 (0.254)	---	0.069 (0.607)	---	0.079 (0.100)	---	**0.017** (0.037)**
Gov. Expenditure	0.092 (0.408)	0.163 (0.298)	-0.008 (0.918)	-0.015 (0.851)	0.057 (0.113)	**0.065** (0.011)**	0.006 (0.268)	0.007 (0.166)
GDP growth	0.360 (0.193)	**0.576** (0.025)**	0.180 (0.505)	0.220 (0.370)	-0.021 (0.587)	0.0004 (0.986)	0.005 (0.291)	**0.008** (0.024)**
Trade	-0.045 (0.315)	-0.057 (0.241)	-0.022 (0.105)	**-0.030* (0.073)**	0.006 (0.514)	0.004 (0.614)	**-0.001** (0.036)**	**-0.001** (0.016)**
Inflation	-0.076 (0.819)	0.206 (0.381)	-0.156 (0.428)	-0.138 (0.522)	-0.067 (0.223)	-0.064 (0.300)	-0.001 (0.853)	0.000 (0.989)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	**(0.158)**	**(0.115)**	**(0.846)**	**(0.855)**	**(0.597)**	**(0.551)**	**(0.131)**	**(0.215)**
Sargan OIR	**(0.134)**	(0.028)	(0.089)	(0.099)	**(0.329)**	**(0.406)**	**(0.638)**	**(0.668)**
Wald (joint)	**100.43*** (0.000)**	**73.21*** (0.000)**	**3761*** (0.000)**	**1910.2*** (0.000)**	**385.57*** (0.000)**	**304.38*** (0.000)**	**402.35*** (0.000)**	**444.09*** (0.000)**
Instruments	18	18	18	18	18	18	18	18
Countries	33	33	28	28	25	25	22	22
Observations	113	113	87	87	80	80	61	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. NODASD2 (Total): Total NODA volatility as Standard Deviations of the Residuals after first-order autoregressive processes.

Table 5: Robustness checks 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 (Educatex)**	**Schooling**
Education (-1)	**1.202*** **	**1.177*** **	**1.057*** **	**1.066*** **	**1.150*** **	**1.164*** **	**1.140*** **	**1.122*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Constant	-15.936	-9.739	1.361	2.087	-0.955	-0.626	0.181	**0.289** **
	(0.196)	(0.524)	(0.583)	(0.317)	(0.309)	(0.244)	(0.240)	**(0.028)**
NODADAC	**1.172** **	---	0.174	---	0.104	---	**0.024***	---
	(0.024)		(0.420)		(0.263)		**(0.054)**	
NODADAC SD2	---	0.719	---	0.077	---	**0.123*** **	---	**0.023** **
		(0.194)		(0.724)		**(0.006)**		**(0.037)**
Gov. Expenditure	0.120	0.202	-0.001	-0.016	**0.060***	**0.070** **	0.007	0.008
	(0.286)	(0.286)	(0.989)	(0.851)	**(0.084)**	**(0.002)**	(0.193)	(0.135)
GDP growth	0.399	**0.573** **	0.189	0.224	-0.025	-0.005	0.005	**0.008***
	(0.162)	**(0.033)**	(0.472)	(0.367)	(0.471)	(0.860)	(0.290)	**(0.055)**
Trade	-0.037	-0.058	**-0.023***	**-0.030***	0.007	0.004	-0.001	**-0.001** **
	(0.385)	(0.212)	**(0.097)**	**(0.081)**	(0.460)	(0.585)	(0.154)	**(0.028)**
Inflation	0.006	0.185	-0.150	-0.140	-0.069	-0.069	-0.001	-0.0004
	(0.983)	(0.451)	(0.457)	(0.522)	(0.257)	(0.253)	(0.860)	(0.947)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	**(0.158)**	(0.122)	**(0.851)**	**(0.891)**	**(0.598)**	**(0.556)**	**(0.132)**	**(0.166)**
Sargan OIR	**(0.126)**	(0.030)	(0.091)	(0.098)	**(0.301)**	**(0.381)**	**(0.599)**	**(0.689)**
Wald (joint)	**106.63*** **	**67.04*** **	**3043*** **	**1699.9*** **	**583.33*** **	**283.91*** **	**470.44*** **	**577.79*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Instruments	18	18	18	18	18	18	18	18
Countries	33	33	27	27	25	25	22	22
Observations	113	113	87	87	80	80	61	61

Panel B: Foreign Aid from Multilateral Donors

	Primary Schooling		**Secondary Schooling**		**Tertiary Schooling**		**Lifelong (Educatex)**	**Schooling**
Education (-1)	**1.235*** **	**1.132*** **	**1.036*** **	**1.053*** **	**1.155*** **	**1.172*** **	**1.126*** **	**1.096*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Constant	-15.450	-6.629	2.010	2.080	-0.366	-0.454	**0.277** **	**0.279** **
	(0.248)	(0.737)	(0.266)	(0.273)	(0.649)	(0.490)	**(0.011)**	**(0.018)**
NODAMD	**1.335** **	---	0.262	---	0.029	---	0.020	---
	(0.029)		(0.229)		(0.850)		(0.292)	
NODAMD SD2	---	1.034	---	0.408	---	0.040	---	0.034
		(0.450)		(0.319)		(0.789)		(0.496)
Gov. Expenditure	0.062	0.092	-0.024	-0.020	0.054	0.054	0.004	0.005
	(0.620)	(0.417)	(0.745)	(0.787)	(0.153)	(0.106)	(0.486)	(0.337)
GDP growth	0.414	**0.533** **	0.174	0.194	-0.008	-0.003	0.007	**0.007***
	(0.156)	**(0.035)**	(0.511)	(0.452)	(0.826)	(0.909)	(0.119)	**(0.082)**
Trade	-0.065	-0.057	-0.023	**-0.028***	0.003	0.002	**-0.001*** **	**-0.002** **
	(0.175)	(0.266)	(0.125)	**(0.071)**	(0.756)	(0.782)	**(0.004)**	**(0.013)**
Inflation	0.007	0.231	-0.154	-0.146	-0.049	-0.043	0.0004	0.001
	(0.980)	(0.311)	(0.437)	(0.468)	(0.349)	(0.444)	(0.948)	(0.880)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	**(0.133)**	**(0.111)**	**(0.848)**	**(0.870)**	**(0.603)**	**(0.553)**	**(0.142)**	**(0.177)**
Sargan OIR	(0.072)	(0.023)	(0.087)	(0.095)	**(0.385)**	**(0.422)**	**(0.643)**	**(0.623)**
Wald (joint)	**85.511*** **	**85.16*** **	**3607*** **	**3112*** **	**283.66*** **	**353.57*** **	**323.54*** **	**303.79*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Instruments	18	18	18	18	18	18	18	18
Countries	33	33	28	28	25	25	22	22
Observations	113	113	87	87	80	80	61	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. NODADACSD2: NODADAC volatility as Standard Deviations of the Residuals after first-order autoregressive processes. NODAMDSD2: NODAMD volatility as Standard Deviation of the Residuals after first-order autoregressive processes.

4. Concluding implications

This paper has put an empirical structure to the demand-side of the Preece (2013) findings. It has assessed whether foreign aid volatility adversely affects demand-side choices of lifelong learning in recipient countries. Lifelong learning is measured as the combined knowledge acquired during primary, secondary and tertiary educational enrolments. Three types of aggregate foreign aid volatilities are computed in a twofold manner: baseline standard deviations and standard errors (standard deviations of residuals after first-order autoregressive processes). An endogeneity robust dynamic system GMM empirical strategy is employed. The findings broadly show that foreign aid volatility does not adversely affect the demand-side choices of lifelong learning in Africa.

The positive effect of development assistance on education is consistent with the stream of literature on the rewards of foreign aid in economic prosperity (Gyimah-Brempong and Racine, 2014; Kargbo and Sen, 2014). This effect should be more apparent when foreign aid is channeled via the educational mechanism (Asiedu and Nandwa, 2007; Asiedu, 2014) possibly because: (i) education, especially in terms of lifelong-learning has been documented to promote non-violence and political stability in Africa countries (Asongu and Nwachukwu, 2016) and (ii) a stable political climate is positive for economic growth because investors prefer ambiguity-safe economic strategies (Le Roux and Kelsey, 2015ab).

The fact that foreign aid volatility does not adversely influence demand-side choices of lifelong learning may imply that, when faced with aid uncertainty, the demand for education would increase. This may be explained by the need for more self-reliance in order to mitigate

income risks or/and the use of education as means of copping with uncertainty. This interpretation is broadly accordance with the stream of authors highlighted in the introduction on the need for more financial self-reliance and recently celebrated foreign aid literatures, notably: the Eubank (2012) Somaliland hypothesis which has been confirmed for the entire African continent (Asongu, 2015b), Moyo's (2009) Dead Aid and Collier's (2007) Bottom Billion.

Moreover, the findings indirectly confirm a stream of the literature sustaining that when faced with uncertainty in external financial flows, countries may recourse to promoting human resource development through lifelong learning and knowledge economy as a competitive advantage. This may also explain why countries which have acknowledged scarcity in external financial flows from natural resources have done relatively better compared to their natural resource-rich counterparts (Amavilah, 2015).

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)
Aid1: NODASD1 (Total)	Volatility of Total NODA by Simple Standard Deviation	Author
Aid 2: NODADACSD1	Volatility of NODADAC by Simple Standard Deviation.	Author
Aid 3: NODAMDSD1	Volatility of NODAMD by Simple Standard Deviation	Author
Aid1: NODASD2 (Total)	Volatility of Total NODA by Standard Deviation of the Residuals after first-order autoregressive process.	Author
Aid 2: NODADACSD2	Volatility of NODADAC by Standard Deviation of the Residuals after first-order autoregressive process.	Author
Aid 3: NODAMDSD2	Volatility of NODAMD by Standard Deviation of the Residuals after first-order autoregressive process.	Author
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. SD1: Distortions by Simple Standard Deviations. SD2: Distortions by Standard Deviations of the Residuals after first-order autoregressive processes.

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
First Volatility from Total NODA	2.841	6.460	0.001	64.113	250
First Volatility from Total NODADAC	1.868	4.790	0.0005	44.404	250
First Volatility from Total NODADMD	1.397	2.712	0.0006	29.353	250
Second Volatility from Total NODA	3.409	8.106	0.005	91.927	250
Second Volatility from Total NODADAC	2.201	6.333	0.001	68.826	250
Second Volatility from Total NODADMD	1.678	2.714	0.000	29.906	250
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. SD1: Volatility by Simple Standard Deviations. SD2: Volatility by Standard Deviations of the Residuals after first-order autoregressive processes.

Appendix 3: Correlation Analysis

GDPg	Trade	Gov.E	Inflation	Aid1	Aid2	Aid3	SD1Aid1	SD1Aid2	SD1Aid3	SD2Aid1	SD2Aid2	SD2Aid3	PSE	SSE	TSE	Educatex	
1.000	0.179	0.254	-0.132	0.114	0.109	0.111	0.219	0.193	0.166	0.145	0.091	0.109	0.095	-0.078	-0.036	-0.006	GDPg
	1.000	-0.070	0.024	-0.083	-0.061	-0.114	0.082	0.050	0.047	0.101	0.091	-0.032	0.261	0.389	0.057	0.283	Trade
		1.000	-0.024	0.078	0.077	0.060	0.014	0.024	0.072	0.028	0.028	0.051	0.019	0.013	0.092	0.087	Gov. E
			1.000	-0.023	-0.011	-0.035	-0.004	0.011	-0.016	-0.003	0.0006	0.016	-0.064	-0.100	-0.081	-0.106	Inflation
				1.000	0.975	0.946	0.770	0.681	0.752	0.756	0.685	0.735	-0.055	-0.488	-0.454	-0.456	Aid1
					1.000	0.854	0.805	0.756	0.706	0.809	0.767	0.692	-0.064	-0.449	-0.440	-0.452	Aid2
						1.000	0.646	0.507	0.750	0.608	0.500	0.734	-0.026	-0.481	-0.422	-0.409	Aid3
							1.000	0.921	0.793	0.949	0.878	0.678	-0.067	-0.239	-0.286	-0.290	SD1Aid1
								1.000	0.528	0.901	0.946	0.459	-0.078	-0.167	-0.250	-0.271	SD1Aid2
									1.000	0.718	0.515	0.902	-0.056	-0.340	-0.333	-0.340	SD1Aid3
										1.000	0.945	0.650	-0.044	-0.217	-0.267	-0.236	SD2Aid1
											1.000	0.452	-0.052	-0.152	-0.228	-0.229	SD2Aid2
												1.000	-0.018	-0.355	-0.360	-0.310	SD2Aid3
													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. SD1: Volatility by Simple Standard Deviations. SD2: Volatility by Standard Deviations of the Residuals after first-order autoregressive processes.

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