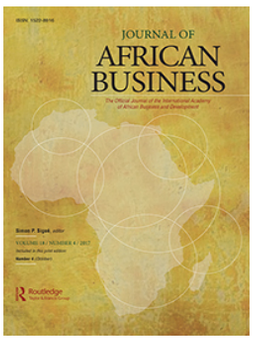

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Aid, Aid Volatility and Sectoral Growth in Sub-Saharan Africa: Does Finance Matter?

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ABSTRACT

This article examines the impact of aid and its volatility on sectoral growth by relying on panel dataset of 37 sub-Saharan African (SSA) countries for the period 1983–2014. Findings from the system-generalized methods of moments show that, while foreign aid significantly drives sectoral growth, aid volatility deteriorates sectoral value additions impacting heavily on non-tradable sectors with no apparent effect on the agricultural sector. The deleterious effect of aid volatility on sectoral value additions in SSA is weakened by a well-developed financial system with significant impact on the tradable sector. Evidently, development of domestic financial markets enhances aid effectiveness.

KEYWORDS

Official Development Assistance; aid; volatility; sectoral growth; sub-Saharan Africa

JEL CLASSIFICATION

F35; O10; O14; O47; O55

1. Introduction

Official Development Assistance (ODA), in its various forms, continues to serve as one of the largest aspect of foreign capital flows to sub-Saharan African (SSA) countries. In fact, the region receives about 35% of total ODA and hosts 13 out of the 20 largest ODA recipients. In 2012, SSA received a total of US$49.5 billion representing 33% of gross ODA while Country Programmable Aid (CPA) also increased significantly by 13% between 2012 and 2013 (Organization for Economic Cooperation and Development [OECD], 2015). The question of how ODA affects economic growth of countries in SSA has received enormous scholarly attention over the years (Ojiambo, Oduor, Mburu, & Wawire, 2015; Rodrik, 1990). What is evident from the results of the growing body of empirical studies are that the effects of ODA on growth vary widely.

Firstly, one strand of literature (Armah & Carl, 2008; Easterly, 2005; Hatemi & Irandoust, 2005; Minoiu & Reddy, 2010) found that ODA helps in the promotion of economic growth through increases in investments and capacity to import goods and technology, complement and supplement domestic resources and saving as well as augment capital productivity. Thus, ODA helps in bridging the saving–investment gap confronting many developing countries. By employing an Autoregressive Distributed Lag (ARDL) model, Gounder (2001) found that aid flows in its various

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forms had a significantly positive impact on economic growth in Fiji. ODA also contribute to economic growth through domestic capital formation supplementation, public investment and human capital development, and increase in physical and human capital investment, and also provides an opportunity to import capital goods and technology in recipient countries (Hansen & Tarp, 2001; McGillivray, 2009; Morrissey, 2001).

Other studies however found that there is a marginal or negative relationship between ODA and economic growth (see Mallik, 2008; Young & Sheehan, 2014). Knack (2001) for instance found that increased volumes of aid had the potential to increase corruption and rent-seeking behavior of state actors and erode institutional quality which by implication affects growth negatively. Using a sample of 39 developing countries between 1975 and 2000, Duc (2006) found a significant negative relationship between aid and economic growth. The other strand of empirical studies (De La Croix & Delavallade, 2013; Ekanayake & Chatrna, 2010; Hansen & Tarp, 2001; Nkusu & Sayek, 2004; Young & Sheehan, 2014) note the inconclusiveness with respect to the relationship between aid and growth.

Ekanayake and Chatrna (2010) found that foreign aid had a mixed impact on economic growth of developing countries. Adams and Atsu (2014) equally found mixed results: in the short-run, aid promotes growth through investments and government spending while in the long-run, trade and financial depth has negative effects on growth. What is evident from these strands of literature is that country-specific factors or internal dynamics including financial markets, policy environments, quality of governance structures, resource endowment, culture and socio-economic characteristics are major determinants of the effectiveness or counter productiveness of aid to growth (Burnside & Dollar, 2000; Winters & Martinez, 2015).

Clear from these growing contestations of the nexus between ODA and growth is the lack of scholarly attention on aid volatility or unpredictability, a major feature of ODA flow that has consequential implications on growth. The studies reviewed above inherently agree that ODA flows are predictable and that recipient countries, through conscious policy strategies, can effectively and timely leverage aid in their national development financing agenda. The studies further assume that aid disbursement and commitments are the same. In fact, the experiences with many SSA countries suggest that aid volatility exist and can have either negative or positive implication on growth depending on the factors that triggered it. Indeed factors that trigger aid volatility may be numerous ranging: (a) failure of recipient countries to adhere to donor conditionalities in safeguarding aid; (b) inability of donors to disburse timely owing administrative constraints; (c) changing donor priorities which results in addition or subtraction; and (d) shocks in the economy which may necessitate donors to provide more aid than the agreed commitment (Celasun & Walliser, 2008).

The discussion on aid sector volatility is important as it could have serious implications on growth. For example, aid volatility could force government to cut investments in areas including human capital development or boost government consumption (Celasun & Walliser, 2008). Rodrik (1990) argues that aid volatility may results in volatility of expenditure and policy instability especially among poor aid-dependent countries while Mosley and Suleiman (2007) also suggest that aid volatility reduces fiscal policies and coherent investment programs in the public sector in recipient countries. Informed by these strands

of view, some commentators have argued that aid volatility negatively affects the effectiveness of aid at the macro-economic level (Lensink & Morrissey, 2000) and leads to macroeconomic instability (Chauvet & Guillaumont, 2009).

Ojiambo et al. (2015) examined the heterogeneous effects of aid on growth in low income economies with different aid unpredictability episodes. The authors found that increased aid volatility has negative effects on growth. They however also found that aid volatility improves economic growth in an unstable macroeconomic environment, a finding they attributed to the point that aid volatility forces government to adopt more prudent measures to manage limited resources during unstable periods. No evidence was reported of different impacts of aid volatility during shocks. Other studies have also suggested that the results of aid volatility on growth are mixed (Hudson, 2013; Hudson & Mosley, 2008).

While these studies offer insight on the effect of aid volatility, they failed to disaggregate the impacts of aid volatility on sectoral value additions. Thus, to the best of our knowledge, little is known about the effects of aid volatility on specific sectors of the economy including agriculture, services and industry. The objective of this paper is to go beyond the debates on aid volatility–growth nexus and to examine the effect of aid volatility on sectoral outputs. Indeed, individual sectoral effects of aid volatility matters in the same manner as overall aid volatility because merely regressing aid on economic growth is not instructive, hence the need for an in-depth knowledge and understanding into how an individual sector is uniquely affected. We are inspired by works of authors such as Hudson (2015), who examined the effects of aid and aid volatility on specific sectors using a database of 50 sectors from the OECD Creditor Reporting System. He found that when debt and humanitarian aid are ignored, the most volatile sectors are linked to government and industry but other social sectors including health and education have low volatilities. The author however called for more studies on aid volatility and sectoral value output.

Indeed, beyond the traditional role of financial sector development in improving *ex ante* information of an underlying investment, mobilizing savings, monitoring corporate governance, trading and risk diversification (see Levine, 1997, 2005), our paper attempts to proffer the alternative role of the domestic financial market where higher level of financial sector development mediates countries' ability to mitigate the effect of aid volatility in such a way that sectoral growth is not jeopardized. In fact, the role of financial sector development in faltering growth volatility has received much attention in recent literature (see Ibrahim & Alagidede, 2017). However, beyond the finance–growth volatility nexus, we argue in this study that well-developed domestic financial markets allow the conduct of effective monetary policies necessary for dampening the private sector growth associated with vagaries of aid inflows.

Incorporating aid volatility into the standard aid–growth framework will provide an indication of the extent to which aid vagaries may have eroded sectoral output over the period under consideration, where the region has received substantial ODA. Undoubtedly, our study provides a strong alternative to examining the aid–growth relationship in SSA. More specifically, our study focuses on the sub-sector effects of aid and aid volatility and how the financial sector development impacts on volatility–sector output nexus. To the best of our knowledge, this is the first study attempting to quantify the unique impact of aid and its volatility on the various sectors of SSA as well as the

role of the domestic financial market in magnifying or amplifying the impact of aid volatility on sectoral value addition. In doing so, we deal with the question of whether aid and its volatility have a counteracting effect on the agricultural, service and manufacturing sectors of the economy.

The remainder of the study is organized as follows. Section 2 examines the trends of aid volatility and its impact on sectoral value additions in the context of SSA. This contextualization will help situate our study in a broader context by offering an insight into the predictability or unpredictability of ODA flows and the extent to which that affects growth on the continent. We then outline our methods, data and empirical strategy, followed by results and discussions. The last part concludes the study with some policy implications.

2. Trends of ODA, sectoral growth and financial sector development in SSA

The growing emphasis on ODA in Africa can be best understood in the context of the poverty and under-development in the sub-region. Poverty ranks as one of the region's most pressing development challenges. An estimated 48.5% of SSA's population subsists on less than US$1.25 a day. With almost 910.4 million people, the region has, by far, the highest poverty rate in the world with about 65% of the population being multi-dimensionally poor (UNDP, 2011; World Bank, 2012). This makes Africa the "signifier of poverty" (Harrison, 2011, p. 1). Moreover, countries in SSA occupy most of the bottom places in many human development indicators including life expectancy, maternal mortality and literacy rates (UNDP, 2015).

This situation coupled with weak institutional and governance structures has created a "development void" which foreign donors, including bilateral and multilateral agencies, have sought to fill through the provision of ODA. The institutionalization of aid can also be seen as a mechanism for creating interaction between developed and less-developed countries. This is also not to downplay the fact that donor agencies may not necessarily allocate aid flow to the neediest regions or countries but are influenced in part by their political and strategic considerations including the rhetoric of better governance, fiscal sustainability and accountability (Collier & Dollar, 2002; Harrigan, Wang, & El-Said, 2006).

As noted earlier, Africa, south of the Sahara, is one of the regions in the world that continue to receive huge volumes of aid. However, flow of aid to the region has been volatile over the years with implications on overall growth and, above all, sectoral value additions. Figure 1 shows the trend analysis of sectoral additions in SSA over the period 1981 to 2015. From Figure 1, we notice marked increases in sectoral value additions, especially in 2015. More importantly, over the sample period, average sectoral value addition is 2.1 and 3.8 times higher than that of agriculture and manufacturing sectors respectively (see Table 1). Indeed, value additions in manufacturing and agriculture are relatively lower and lackluster even when the latter is higher. What is clear from Figure 1 is that that growth in agriculture value additions is non-monotonic, although the trend is generally decreasing over the period. The agriculture sector recorded its highest value addition of 24.28% in 1986–1990, which coincided with the period the service sector registered its lowest value addition of 42.71% (see Table 1).

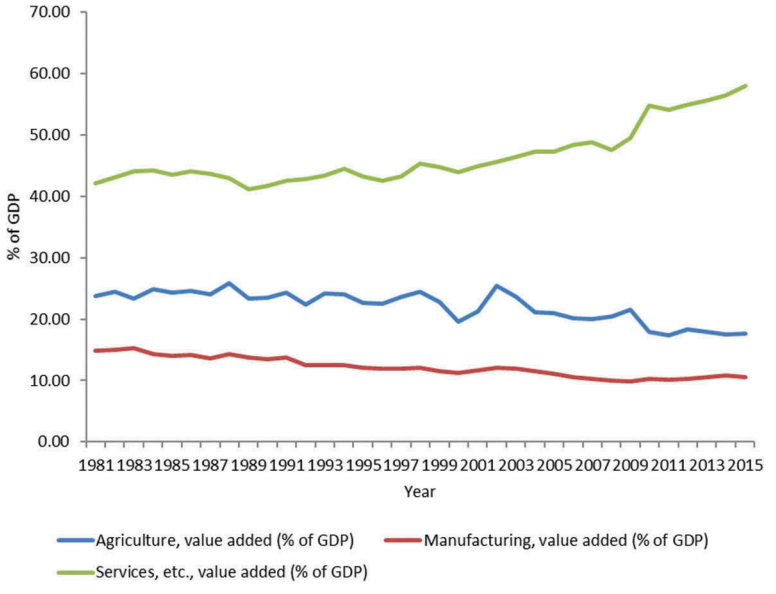

Figure 1. Trend of Sectoral Value Additions in SSA.
Source: Authors' construct from WDI.

Table 1. ODA, Financial Development and Sectoral Value Additions in SSA.

Year	Net ODA received (% of GNI)	Domestic credit to private sector (% of GDP)	Domestic credit provided by financial sector (% of GDP)	Agriculture, value added (% of GDP)	Manufacturing, value added (% of GDP)	Services, etc., value added (% of GDP)
1981–1985	3.40	34.90	53.16	24.16	14.69	43.40
1986–1990	5.12	40.79	56.61	24.28	13.86	42.71
1991–1995	6.06	55.92	70.19	23.52	12.64	43.32
1996–2000	4.17	58.25	70.21	22.58	11.73	43.92
2001–2005	5.09	55.47	74.65	22.47	11.67	46.29
2006–2010	4.28	59.21	70.02	19.99	10.17	49.80
2011–2015	3.02	47.69	60.08	17.73	10.47	55.85
1981–2015	4.45	50.32	64.99	22.10	12.18	46.47

Source: Authors' calculations from WDI.

Interestingly, we observed a lowest value addition of 17.73% in the agricultural sector and aid inflows (as a percentage of GNP) of 3.02% for the period 2011–2015, which also coincided with the period where the service sector recorded its all-time highest value addition of 55.85%. Manufacturing value addition has been consistently reducing from 14.69% in 1981–1985 to 10.47% in 2011–2015, although this rate represented a slight increase from 10.17% in 2006–2010. The lower manufacturing value addition is expected given the region's economic structure in terms of reliance on agriculture which is biased towards production of raw materials relative to manufacturing. Values of financial development indicators show that average domestic credit provided by financial sector (% of GDP) is consistently larger than domestic credit to private sector (% of GDP) with an overall mean of 64.99%.

The analyses here show some revealing evidence of inter-relationships among aid inflows and sectoral growth where financial systems may provide intermediation roles.

3. Data and methodology

3.1. *Data and preliminary findings*

To test our hypothesis, we construct a balanced panel dataset of 37 SSA countries for the period 1983–2014.[1] The choice of these countries is based entirely on data availability for a sufficiently long time period. Annual data for all the variables were gleaned from the World Development Indicators (WDI) of the World Bank. We used ODA to GDP ratio to proxy foreign aid. Sectoral growth is proxied by the real value added output in agriculture, service and manufacturing. Specifically, value addition in the agricultural sector is the net output of a sector after adding up all outputs and subtracting intermediate inputs, while that of the service sector include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional and personal services such as education, health care and real estate services. Manufacturing sector value added comprises of value additions in manufacturing, mining, construction, electricity, water and gas. Indeed, sectoral value additions are computed as the net output of a sector after summing all outputs and subtracting intermediate inputs. The origin of value added is determined by the International Standard Industrial Classification (ISIC) revision 3, and annual growth rate for all sectors are based on constant 2005 US dollars.

We present the distribution of aid and the various sectoral outputs in the Appendices. We used credit provided by the financial sector to the private sector as percentage of GDP to proxy the quality of financial development. Our control variables are based on the standard neoclassical growth theory and include inflation, investment rate, government expenditure, institutional quality, labor and trade openness. The inflation variable is the annual percentage change in the consumer price index and used to proxy macroeconomic (in)stability. This is expected to negatively impact on sectoral growth. We use gross fixed capital formation as a percentage of GDP to proxy investment rates and this is expected to positively influence sectoral value additions. Government expenditure expressed as a percentage of GDP measures final government consumption expenditure and is used to measure government size. The institutional quality variable is a continuous variable ranging from 0 to 4, with a higher score indicating a better quality. Obtained from the International Country Risk Guide (ICRG), this is used to measure the quality of government institutions that affect property rights or the ability to conduct business. Labor is proxied by the percentage of economically active population aged 15 to 64 years. We provide the descriptive statistics and correlation coefficients of the variables in Appendices 4 and 5 respectively.

3.2. *Modelling aid volatility*

Some authors (see Chervin & Van Wijnbergen, 2010; Markandya, Ponczek, & Yi, 2010; Ojiambo et al., 2015) have used the standard deviations where aid volatility is measured

according to the degree to it deviates along the mean trend. However, this measure assumes that aid inflows is normally distributed empirically and obscures the distribution between unpredictable elements of the aid process hence failing to capture the past information of aid inflow. We therefore estimate a time-varying volatility on account of the weaknesses of the traditional standard deviation measure. In this study, we rely on the generalized autoregressive conditional heteroskedasticity (GARCH) developed by Bollerslev (1986) largely because it captures past values of the aid and corrects for the intrinsic weaknesses of the traditional measure. Similar to Alagidede and Ibrahim (2017), we allow the log of aid to depend on its previous value for the mean equation. We derive our GARCH model as follows:

$$\mathrm{In}AID_t = \propto_1 + \beta^{|}\mathrm{In}AID_{t-1} + \varepsilon_t \tag{1}$$

$$\varepsilon_t|\Omega_t \sim iid\,\mathrm{N}(0,\ \vartheta_t)$$

$$\vartheta_t = \aleph_0 + \tau\mu_{t-1}^2 + \theta\vartheta_{t-1} \tag{2}$$

where $\aleph_0 > 0$, $\tau \geq 0$ and $\theta \geq 0$

Therefore, our conditional variance h_t captures the mean ($\aleph_0$), information about the previous volatility, ε_{t-1}^2 (ARCH term) and the past forecast error variance, ϑ_{t-1} (GARCH term). Our GARCH model permits the error term to assume a time–varying variance contingent on the past behavior of aid inflows. Values of the extracted conditional variance of aid are used to proxy aid volatility and are used in all subsequent estimations.

Figure 2 shows the trend of aid volatility extracted via GARCH. It is clear over the sample period that aid to SSA has been volatile and persistent with a deep negative ditch recorded in 2000.

3.3. *Empirical strategy*

Empirically, regression models are used to study the relationship between aid and growth. Following this, we specify Equation (3) where sectoral growth depends on the level of aid inflows and other conditioning variables:

$$SEC_{it} = f(AID_{it},\ VOL_{it},\ Z_{it},\ \varepsilon_{it}) \tag{3}$$

where SEC_{it} is sector growth of country i at time t; AID_{it} is aid; VOL_{it} is aid volatility Z_{it} is a vector of control variables; ε_{it} is the error term while t and i are time and country indices respectively.

We examine the sectoral effect of aid and aid volatility by setting a baseline model where sector growth depends on its one period lag, aid and its volatility and a set of controls estimated in Equation (4):

$$SEC_{it} = \beta_o SEC_{it-1} + \beta_1 AID_{it} + \beta_2 VOL_{it} + \beta_3 Z_{it} + \gamma_i + \mu_t + \varepsilon_{it} \tag{4}$$

where SEC_{it-1} is the sector growth lag representing the initial conditions in examining convergence; γ_i is the country–specific fixed effects; μ_t is the time effects while ε_{it} is the idiosyncratic error term.

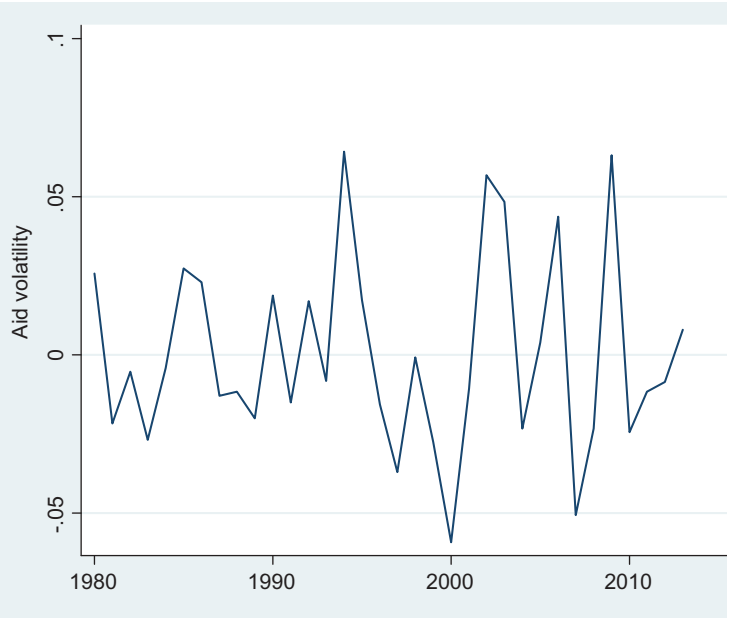

Figure 2. Foreign Aid Volatility.
Source: Authors' construct using WDI.

It is instructive to state that a significant problem exists in the aid–growth literature. This relates to the possibility of obtaining biased results stemming from potential endogeneity of aid in respect to growth. Indeed, donor countries may incentivize a recipient country with a high level of sectoral growth by providing huge foreign aid. Conversely, some donor countries may also wish to channel large aid flows to slow–growing poor countries and may also direct that a proportion of the inflows be channeled to a specific sector which they believe intrinsically lags relative to other sectors (Hepp, 2008). Thus, there might be a negative association between sectoral output value additions and aid inflows. Simultaneously, if some donor countries have higher preference for directing more aid to fast-growing countries (and more specifically certain sectors of the economy), then we expect a positive correlation between sectoral output and aid. In such a framework, one might anticipate the other variables perceived to influence sectoral growth to potentially correlate with sectoral output.

The majority of the active population of SSA's labor force is more probable to engage in agriculture thereby increasing its sectoral output and freeing resources/inputs to other sectors, notably manufacturing. Moreover, relatively efficient sector players may demand improved institutional quality to allow sound service delivery hence boosting income. We resolve these potential endogeneities by employing the system generalized methods of moments (SYS–GMM). Specifically, we estimate Equation (4) by employing the SYS–GMM dynamic pooled estimator as it resolves the econometric problems inspired by endogeneity of the lagged dependent (SEC_{it-1}) as well as potential unobserved country-specific effects. We rely on the SYS–GMM relative to the difference GMM due to the latter's poor finite properties when the regressors are persistent

(Arellano & Bover, 1995).[2] The main advantage for our choice of this approach is that it provides more precision in the estimations as well as correcting for biases beset with existing studies on the aid–growth nexus owing from the introduction of its extra moments.

Since all regressors may be endogenous, we instrument with two lags of themselves in the first difference equation, and a one lag of their first difference in the level equation. We investigate the channels through which financial development magnifies or dampens aid volatility effect on sector growth by including a multiplicative interaction term of VOL_{it} and financial development. Consequently, we specify our general system GMM framework from Equation (4) as:

$$SEC_{it} = \sum_{p}^{k=1} \gamma_k SEC_{it-k} + \alpha_1 AID_{it} + \alpha_1 VOL_{it} + \alpha_1 (VOL_{it} \times FD_{it}) + Z_{it}\beta + \epsilon_{it} \qquad (5)$$

$$t = p + 1, \ldots\ldots\ldots, \; T; i = 1, \; 2, \ldots\ldots N$$

$$\epsilon_{it} = \gamma_i + \mu_t + \varepsilon_{it}$$

where β is the vector of parameters associated with each explanatory variable; p is the maximum lag in the model; FD_{it} is financial development. The other variables remain as previously defined.

Our panel SYS–GMM estimator relies on pooled cross-country and time series properties while utilizing additional information provided by the variations in the level of sectoral growth and associated factors influencing it. Indeed, the efficiency of our estimates depends on the validity of the instruments which we address using two formal tests: serial correlation test and Sargan's test for over-identifying restriction. While the serial correlation test examines the null hypothesis that the error term is serially uncorrelated [whether first, AR(1) or second order, AR(2)], Sargan's test examines the exogeneity of the instruments with the null hypothesis that over-identifying restrictions are valid.

4. Results and discussions

This section presents the empirical findings on the aid volatility–sectoral value additions nexus. Specifically, we regress sectoral growth proxied by real value additions of agriculture, service and industrial sector on their one period lag together with aid, aid volatility and other standard controls selected with recourse to standard literature. We also include the multiplicative interactive term of aid volatility and financial sector development. To eliminate time and country level heterogeneity in the sectoral value addition process, our estimations include time and country effect dummies and results from SYS–GMM are presented in Tables 2–4.

Conditional convergence hypothesizes that economies have a penchant of converging toward a steady-state path (Solow, 1956). In this study, we argue that sectoral output growth in SSA will depend on the initial value additions. Following this logic, we capture the conditional convergence effects by including the initial/lagged output levels of agriculture, service and manufacturing sectors in their respective models. From

Table 2. Aid, Aid Volatility and Agricultural Sector Value Additions.

	Agriculture			
Variables	1	2	3	4
Lagged dependent	−1.412(0.191)***	−1.393(0.174)***	−1.301(0.156)***	−1.222(0.294) ***
Investment	0.052(0.033)	0.048(0.042)	0.037(0.028)	0.043(0.039)
Government size	0.021(0.017)	0.017(0.016)	0.020(0.015)	0.019(0.013)
Inflation	−0.009(0.002) ***	−0.010(0.005)**	−0.021(0.009)**	−0.018(0.006)**
Trade openness	0.151(0.069)**	0.160(0.064)**	0.169(0.071)**	0.172(0.040) ***
Labor	0.090(0.028) ***	0.081(0.012)***	0.078(0.011)***	0.079(0.039)**
Institutional quality	0.099(0.016) ***	0.096(0.016)***	0.111(0.012)***	0.171(0.028) ***
Aid	0.109(0.010) ***	0.121(0.059)**	0.160(0.022)***	0.175(0.037) ***
Aid volatility	–	−0.007(0.004)*	−0.032(0.028)	−0.018(0.014)
Fin. development	–	–	0.157(0.131)	–
Channels:				
Volatility and fin. development	–	–	–	−0.031(0.024)
Diagnostics:				
Number of countries	37	37	37	37
Country fixed effects	YES	YES	YES	YES
Time effects	YES	YES	YES	YES
AR(1) z–value [*p*–value]	−3.023 [0.009]	−3.129[0.005]	−3.331[0.005]	−3.412[0.007]
AR(2) z–value [*p*–value]	−1.319 [0.317]	−1.422[0.419]	−1.223[0.391]	−1.412[0.201]
Sagan chi-square [*p*–value]	10.091[0.241]	11.715[0.312]	14.812[0.472]	13.031[0.500]
Wald chi-square [*p*–value]	0.0000	0.0000	0.0000	0.0000

Note. ***, ** and * denote significance at 1, 5 and 10% level. All variables are estimated in logs and coefficients are their respective elasticities.

Table 3. Aid, Aid Volatility and Service Sector Value Additions.

	Service			
Variables	1	2	3	4
Lagged dependent	−1.019(0.311) ***	−1.117(0.475)**	−1.302(0.145)***	−1.537(0.275) ***
Investment	0.071(0.023)**	0.075(0.030)**	0.081(0.033)**	0.078(0.029)**
Government size	0.051(0.041)	0.057(0.054)	0.061(0.055)	0.062(0.031)*
Inflation	−0.016(0.004) ***	−0.019(0.002)***	−0.020(0.002)***	−0.022(0.003) ***
Trade openness	0.193(0.070)**	0.154(0.069)**	0.137(0.015)***	0.110(0.050)***
Labor	0.071(0.034)**	0.076(0.032)**	0.071(0.029)**	0.082(0.041)**
Institutional quality	0.073(0.031)**	0.081(0.014)***	0.092(0.017)***	0.091(0.020) ***
Aid	0.016(0.008)*	0.027(0.013)**	0.048(0.021)**	0.0970(0.046)**
Aid volatility	–	−0.063(0.026)**	−0.045(0.019)**	−0.051(0.019)**
Fin. Development		–	0.151(0.022)***	–
Channels:				
Volatility and fin. Devt	–	–	–	−0.048(0.017)**
Diagnostics:				
Number of countries	37	37	37	37
Country fixed effects	YES	YES	YES	YES
Time effects	YES	YES	YES	YES
AR(1) z–value [*p*–value]	−3.209[0.002]	−3.514 [0.001]	−3.607[0.001]	−3.912[0.001]
AR(2) z–value [*p*–value]	−1.111[0.731]	−1.931[0.549]	−1.870[0.614]	−1.763[0.553]
Sagan chi-square [*p*–value]	14.018[0.414]	10.192[0.327]	13.044[0.411]	12.772[0.392]
Wald chi-square [*p*–value]	0.000	0.000	0.0000	0.0000

Note. ***, ** and * denote significance at 1, 5 and 10% level. All variables are estimated in logs and coefficients are their respective elasticities.

Tables 2–4, the coefficient of the respective lagged dependent of each sector is negative and significant at conventional levels, predicting countries' conditional convergence to their own steady state sectoral output.

We introduced key variables in sessions to assess the stability and robustness of the effects on sectoral growth. Columns 1 to 4 in Table 2 present findings on how the independent variables affect real value additions of the agriculture sector. The

Table 4. Aid, Aid Volatility and Manufacturing Sector Value Additions.

	Manufacturing			
Variables	1	2	3	4
Lagged dependent	−1.102(0.129) ***	−1.305(0.146)***	−1.611(0.202)***	−1.871(0.231) ***
Investment	0.081(0.033)**	0.087(0.035)**	0.073(0.034)**	0.093(0.071) ***
Government size	0.077(0.058)	0.052(0.051)	0.059(0.053)	0.061(0.049)
Inflation	−0.071(0.011) ***	−0.066(0.026)**	−0.059(0.023)**	−0.062(0.009) ***
Trade openness	0.241(0.041) ***	0.239(0.025)***	0.250(0.030)***	0.216(0.035) ***
Labor	0.086(0.043)*	0.090(0.047)*	0.098(0.051)*	0.129(0.063)**
Institutional quality	0.087(0.019) ***	0.090(0.010)***	0.097(0.011)***	0.096(0.022)***
Aid	0.026(0.009)**	0.030(0.013)**	0.041(0.018)**	0.033(0.012)**
Aid volatility	–	−0.063(0.021)**	−0.055(0.018)**	−0.041(0.013)**
Fin. Devt			0.142(0.014)***	–
Channels:				
Volatility and fin. development				−0.055(0.013) ***
Diagnostics:				
Number of countries	37	37	37	37
Country fixed effects	YES	YES	YES	YES
Time effects	YES	YES	YES	YES
AR(1) z–value [*p*–value]	−3.477 [0.009]	−3.096 [0.004]	−3.111[0.001]	−3.213[0.002]
AR(2) z–value [*p*–value]	−1.501 [0.301]	−1.152[0.211]	−1.532[0.240]	−1.332[0.217]
Sagan chi-square [*p*–value]	12.312[0.410]	15.442[0.291]	11.276[0.315]	12.900[0.421]
Wald chi-square [*p*–value]	0.000	0.000	0.0000	0.0000

Note. ***, ** and * denote significance at 1, 5 and 10% level. All variables are estimated in logs and coefficients are their respective elasticities.

coefficient of gross fixed capital formation is positive for all sectors but its effect on agricultural value addition is not significant. This is irrespective of the model choice. With regard to the service sector, our finding suggests that a unit percentage increase in investment rate increases its value addition by at least 0.071% (column 1) and 0.081% for the manufacturing sector. In columns 2 and 3 where we control for aid volatility and financial development, the growth effect of investment rate on both service and manufacturing value additions increase. This finding is unsurprising as investment in capital build up is expected to boost infrastructure thus paving the way for expansion in both sectors. The effect of fiscal policy proxied by government expenditure is positive albeit insignificantly, suggesting that government expenditure does not matter in sectoral value addition. This evidence perhaps echoes the form of government expended in SSA and may reflect that quality relative to quantity of expenditure matter in propelling structural economic changes. This argument is well illustrated in Ibrahim and Alagidede (2016) where the authors opine that government expenditure in SSA is often spent on unprofitable projects.

In terms of the effect of macroeconomic instability proxied by inflation, our results indicate that increases in inflation are associated with reduced value additions in all sectors. This finding is robust irrespective of the model specification, suggesting that maintaining a stable macroeconomic environment is crucial in promoting sectoral growth. Turning to the effect of international openness on sectoral growth, our findings suggest that de-restricting trade barriers can potentially increase value additions in all sectors with large effects in manufacturing (see Table 4, columns 1–4). The effect of trade openness is insensitive to model specification, given the robust positive effect on output. Beyond promoting competition, openness to international markets allows technological transfer permitting sectors to produce goods and services at lower unit costs. The effect of labor in output growth is positive and statistically significant, suggesting that an

increasing population in the region is associated with higher sectoral growth. Further findings show that higher institutional quality is output-enhancing. Specifically, an increase in the quality of institutions promotes value additions in agriculture, service and the manufacturing sectors, although higher effect is recorded in the agricultural sector. Apart from enhancing capacity, improvement in institutions alleviates structural bottlenecks inhibiting sectoral productivity and ultimately spurring output.

On aid–sectoral growth nexus, we find a positive and statistically significant effect of aid on agricultural output, suggesting that aid inflows to SSA propels agricultural output. From Table 2, a unit percentage rise in aid significantly increases agricultural sector value addition by 0.109% (column 1). The positive effect of aid on agriculture remain robust even when we control for aid volatility (column 2), financial development (column 3) and transmission channel (column 4) with higher elasticity recorded in the model containing the indirect effect (column 4). Similarly, foreign aid is also associated with higher service and manufacturing output. The elasticity effect of aid on the service sector ranges between 0.016 to 0.097% relative to 0.026 to 0.041% of the manufacturing sector. Thus, foreign aid inflows propel structural economic transmission and may well reveal the interdependence of the various sectors in the production process.

The agricultural sector provides the input necessary for production while the service sector provides the intermediation role by creating a sound environment for manufacturing to thrive. Indeed, those manufacturing industries that rely heavily on the service sector benefit from efficient transportation services, ICT, energy and other service provisions thereby spurring manufacturing output. Thus, apart from propelling agricultural sector production, the positive impact of aid suggests improvements in service provision permitting downstream users of these services. While aid promotes sectoral value additions, their effect is largely disproportionate. Notice that the effect of aid on agricultural output is large and increases substantially with a rather reduced magnitude on manufacturing. Given the highest effect of aid on each sector, the impact of foreign aid on agriculture is at least 1.8 and 4.3 times higher than that of service and manufacturing sectors respectively. We attribute this to the high concentration of agriculture where additional resources potentially increase production. Defined as an income transfer to governments, to the extent that foreign aid permits increased public spending and investment, these findings are particularly apt as efficiency in services (dis)proportionally benefits all sectors, although the output-enhancing effect on manufacturing is low perhaps due to the nascent manufacturing sector.

We controlled for the direct effect of aid volatility on sectoral output and the results are shown in Table 2, columns 2–4. Our findings show a negative impact of aid volatility on agricultural, service and manufacturing output. The implication is that while aid promotes growth in these sectors, vagaries in aid dampen its enhancing effect. From Table 2, column 2, a 1% rise in aid volatility reduces agricultural sector growth by 0.07% and this effect is slightly significant at 10%. However, the volatility-damaging effect on agriculture loses its significance when we control for financial development (column 3) and transmission channel (column 4). Thus, relative to service and manufacturing, the agricultural sector is immune from the adverse effects of unpredictable pattern of aid. This finding is akin to Chauvet and Guillaumont (2009). These authors showed that aid, even if aid is volatile, it is not as procyclical as is often argued, and, even if procyclical, it is not necessarily destabilizing, with the (de)stabilizing nature of

aid measured by the difference in the volatility of (i) exports and (ii) aid plus export flows. That the agricultural sector in SSA mainly provides inputs for other sectors in the processing and exporting sector perhaps explains the subtle effect of volatility.

On the policy front, this finding highlights the need to avoid the apparent assumption that aid volatility has homogenous effects across different sectors of the economy as the aid volatility–sectoral growth nexus is heterogenous. While volatility may not have a significant effect on a sector such as agriculture, it may have a small negative effect on service, thus hindering its improvement, or a large negative effect on manufacturing.

In other words, although the coefficient of aid volatility is negative and significant (at 5%) for service and manufacturing sectors, its effect is huge in the former. These findings suggest that revenue volatility deteriorates output and can potentially present severe problems to developing economies like those in SSA. As argued by Mosley and Suleiman (2007), the government of the recipient country's capacity to execute productive investments and fiscal policies is inhibited by aid fluctuations. With the revenue inflows, of which a high proportion goes to poor countries as aid, fluctuations in aid may result in volatility of expenditure and instability of policy (Rodrik, 1990). Overall, our findings could explain why countries in SSA have made little progress transforming their structure despite the ODA inflows.

Given the negative effects of volatility on sectoral value additions in SSA, this study hypothesizes that improvements in domestic financial sector falters aid vagaries. We test this hypothesis by including a multiplicative interactive term of volatility and financial development proxied by credit to the private sector (column 4, Tables 2–4). Consistent with our hypothesis, we find a negative coefficient of the interactive term suggesting that countries with well-developed financial sectors are associated with lower volatility. This finding is somewhat akin to Nkusu and Sayek (2004). A plausible explanation from this study may be that, because aid provides more resources to governments of the recipient countries, it reduces their appetite to compete with the private sector for credit from the domestic financial sector thereby freeing credit to the private sector. However, the dampening effect of financial development is insignificant in the agricultural sector. Indeed, countries in SSA have a high comparative advantage in agriculture (see Collier & Venables, 2007) with the majority of agriculture-based economies having an agriculture contribution to GDP averaging 34% (Hayami, 2005).

This notwithstanding, commercial banks in SSA lend less than 10% of their total credit to the agricultural sector with the exception of Malawi, Tanzania and Uganda (Mhlanga, 2010). However, manufacturing and industrial sectors are seen as sound destinations for bank lending because they are insulated from the inherent challenges faced by the agriculture sector. Agriculture creates special challenges for financial institutions due to its spatial and risk characteristics (see Antonaci, Demeke, & Vezzani, 2014; Meyer, 2011). However, financial sector programs aimed at ameliorating these problems produced disappointing results (Meyer, 2015) on the back of an underdeveloped financial sector (Ibrahim & Alagidede, 2016). Thus, the inability of the region's financial sector development to tame volatility in the agricultural sector is unsurprising.

We turn to the reliability of the results. The *p*-values of the Wald chi square statistic shows jointly significance of all regressors in each model. Results from our diagnostic checks rejected the null hypotheses for Sagan's tests thus supporting the validity of the instruments. Our tests for first- [AR(1)] and second- [AR(2)] order correlation show

absence of first-order serial correlation and the presence of AR(2) given the high (low) *p*-values (*z*-values). Our findings therefore provide some consistent and unbiased estimates given the valid instruments and robust results.

5. Conclusion and policy implication

Our purpose in this paper is to go beyond the debates on aid volatility–growth nexus and to examine the effect of aid and aid vagaries on sectoral value additions. More importantly, the individual sectoral effect of aid volatility matters in the same manner as total aid volatility because merely regressing aid on economic growth is not instructive. This paper therefore examines the effect of aid and its volatility on sectoral growth in SSA using on a balanced panel dataset of 37 countries for the period 1983–2014. We resolve potential endogeneities in aid–sectoral growth nexus by employing the system generalized methods of moments (SYS–GMM) while dealing with country-specific effects.

Our findings show a positive and significant impact of aid on agricultural, service and manufacturing output suggesting that aid inflows to SSA propels sectoral value additions. In other words, foreign inflows spur both the tradable and non-tradable sectors, revealing some degree of interdependence. This notwithstanding, aid volatility deteriorates sectoral value additions with a huge impact on the non-tradable sector. However, aid vagaries do not appear to impact on the agricultural sector. The immunity of this sector from the ravages of the unpredictable pattern of aid can be attributed to the comparative advantage the region already enjoys, hence any volatility in aid inflows does not seem to matter for agricultural output. Consistent with our hypothesis, the damaging effect of aid volatility on sectoral growth in SSA is weakened by a well-developed financial system with a large dampening impact on the tradable sector (such as manufacturing) and no apparent influence on agriculture. Aid provides more resources to governments of the recipient countries, reduces the crowding out of the private sector stemming from government borrowing from the financial sector, and consequently releases credit to the private sector.

The main thrust of this paper is that aid can generate positive sectoral value additions conditioned on the level of the local financial sector. Our results reveal that the larger size of financial markets increases sectors' "financial" stabilizing capacity, enabling authorities to administer aid inflows in a manner that spurs aid delivery and effectiveness. Our empirical evidence therefore provides unequivocal support for the notion that development of domestic financial markets by far enhances aid effectiveness. This paper unearths critical findings that call for further development of local financial systems. Central banks of SSA countries need to identify the threshold of financial development consistent with sectoral growth.

Notes

1. These countries are Benin, Botswana, Burkina Faso, Cape Verde, Cameroon, Burundi, Congo, Rep., Cote d'Ivoire, Central African Republic, Chad, Congo, Dem. Rep., Ethiopia, Gabon, Ghana, Gambia, The, Guinea-Bissau, Kenya, Lesotho, Madagascar, Mali, Mauritius,

Malawi, Nigeria, Niger, Namibia, Mozambique, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Togo, Uganda, Zimbabwe and Zambia.

2. Ibrahim and Alagidede (2017) also used this approach as a sensitivity check in their examination of the relationship among financial development, economic volatility and shocks in SSA.

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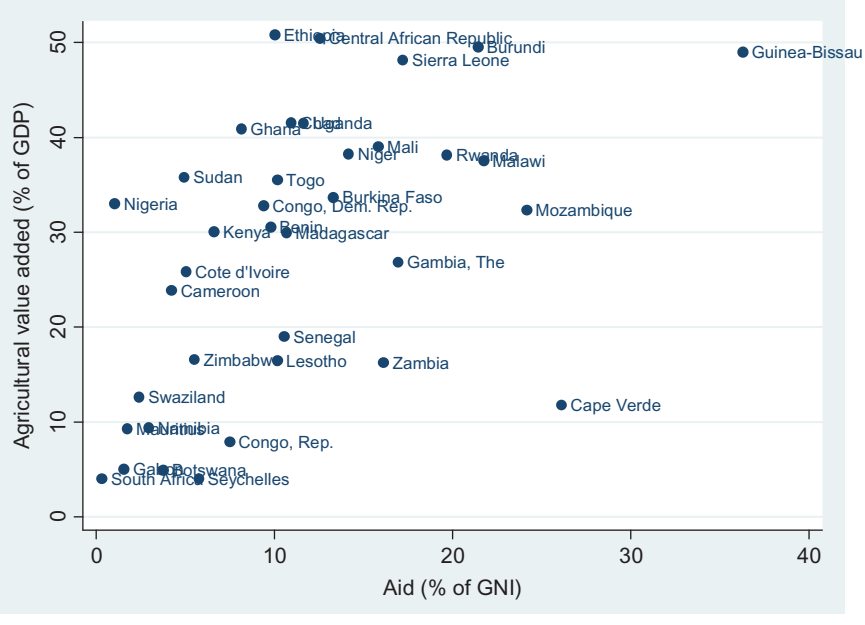
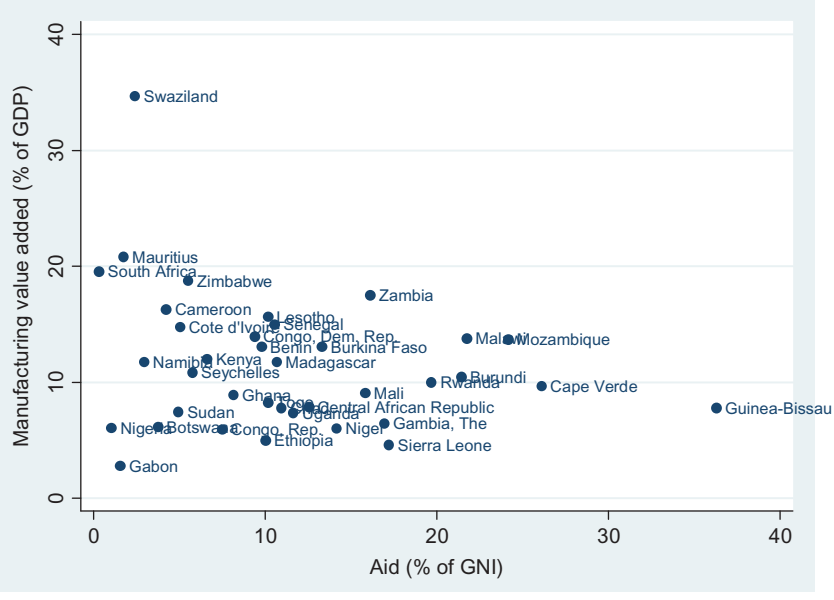
Appendices

Appendix 1: Foreign aid and agricultural sector [Average: 1983–2014]



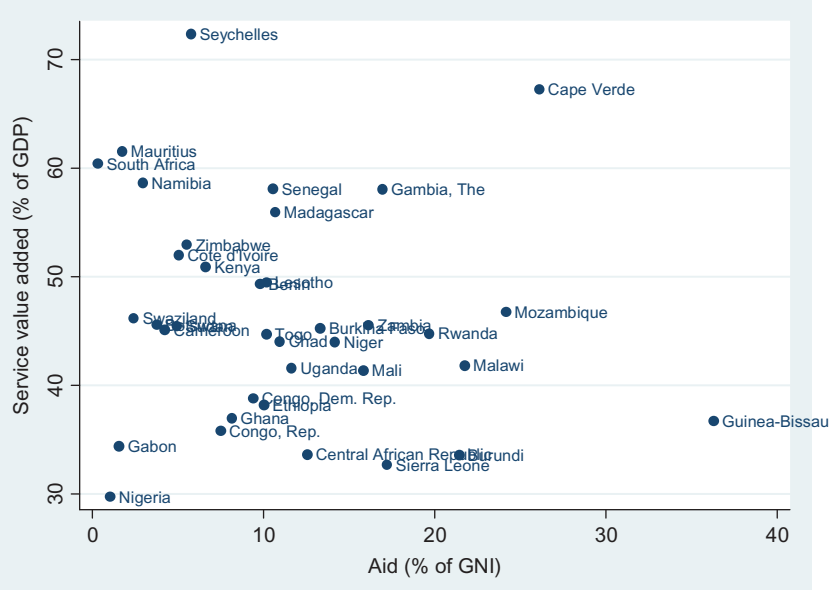
Source: Authors' construct using WDI.

Appendix 2: Foreign aid and manufacturing sector [Average: 1983–2014]



Source: Authors' construct using WDI.

Appendix 3: Foreign aid and service sector [Average: 1983–2014]



Source: Authors' construct using WDI.

Appendix 4: Descriptive statistics (1983–2014)

	Agriculture	Service	Manufacturing	Aid	Inflation	Institutional quality	Gross fixed capital formation	Government expenditure	Labor	Trade openness	Domestic credit
Mean	42.646	19.233	38.075	16.748	26.449	2.94	21.183	12.311	50.450	60.050	16.087
Median	42.354	18.276	38.768	14.820	21.908	2.03	21.512	11.579	50.386	61.247	14.692
Maximum	51.849	27.549	44.162	29.404	122.875	3.51	31.010	17.577	52.347	83.564	39.127
Minimum	35.033	14.179	30.258	10.209	8.727	1.94	12.149	8.432	49.584	47.064	10.268
Std. Dev.	4.520	3.771	3.157	4.888	21.803	2.10	3.690	2.764	0.635	8.848	5.571
Skewness	0.231	0.542	−0.806	0.783	2.882	0.13	−0.308	0.497	1.354	0.416	2.372

Source: Authors' calculations using WDI.

Appendix 5: Correlation coefficients

	Agriculture	Service	Manufacturing	Aid	Inflation	Institutional quality	Gross fixed capital formation	Government expenditure	Labor	Trade openness	Domestic credit
Agriculture	1.000										
Service	−0.719	1.000									
Industry	−0.562	−0.170	1.000								
Aid	0.469	−0.596	0.057	1.000							
Inflation	0.330	−0.367	−0.027	0.289	1.000						
Institutional quality	0.031	0.252	0.132	0.111	−0.180	1.000					
Gross fixed capital formation	0.075	0.351	−0.519	−0.115	−0.262	0.222	1.000				
Government expenditure	0.125	−0.402	0.272	−0.138	−0.208	−0.065	−0.211	1.000			
Labor	−0.350	−0.075	0.591	0.241	0.418	−0.116	−0.627	−0.145	1.000		
Trade openness	−0.532	0.753	−0.148	−0.457	−0.396	0.094	0.304	−0.148	−0.032	1.000	
Domestic credit	−0.208	−0.202	0.550	0.185	0.548	0.463	−0.525	−0.086	0.756	−0.223	1.000

Source: Authors' calculations using WDI.