Does Official Development Assistance Volatility Influence Agricultural Productivity Growth in Sub-Saharan Africa?

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Received: 14 December 2019 Accepted: 4 January 2020 Published: 15 January 2020

Abstract

Agriculture is of paramount importance of Sub- Sahara African (SSA) countries. Owing to that, governments and donors invest in the agricultural sector in order to meet the sustainable development goals. However, gaps are observed between official development assistance (ODA) disbursements and commitments. Therefore, this paper investigates the effect of ODA and its volatility on agricultural productivity growth in SSA over the period 2002-2015, using a random effect model. The findings reveal a negative and significant effect of ODA volatility on agricultural productivity growth. The findings suggest that SSA countries partners may continue helping them to boost the agricultural productivity growth through ODA and reduce the gap between ODA disbursements and ODA commitments, to make ODA more predictable.

Index terms— agriculture, foreign agricultural aid, subsaharan africa, volatility.

1 Introduction

2 ub-Sahara

African (SSA) countries are characterized by high level of poverty and low economic diversification associated with low productivity (IMF, 2014). In these countries, around 60-70% of the population are in the rural areas and depend largely on rain-fed agriculture which needs to undergo a structural transformation (ACET, 2014). Actually, the agricultural sector which is mostly rain-fed is the main contributor to employment generation in these countries. However, the contribution of agriculture to the gross domestic product (GDP) is about 17.4% in 2016 (World Bank, 2018), which is quiet low depicting low agricultural productivity, as between 60% and 70% of the population do not contribute at least to 50% of GDP. This fact appeals for policies towards improving agricultural productivity. It is acknowledged that support to the agricultural sector is of paramount importance for poverty reduction. Certainly, agricultural growth has a larger poverty-reducing effect compared to nonagricultural growth (Lewis, 1954;Mellor, 2001;Dercon and Christiaensen, 2005; **??**hristianensen et al., 2010). Actually, a powerful way to increase farmers' income and to reduce rural poverty could be to improve agricultural productivity (Gollin et al., 2002;Fox and Pimhidzai, 2011;ACET, 2014). Therefore, policies aiming to trigger or boost the transformation of the agriculture are of paramount importance in SSA. It should be noted that the transformation of the agricultural sector has the potential to lead to the overall transformation of the economies. Due to huge differences in well-being across developed and developing countries which are staggering, there is a demand for transfers of income from the former to the latter (Alesina and Weder, 2002). These transfers may help SSA countries to boost and sustain agricultural growth and in-fine to boost the overall economic growth.

Actually, to boost agricultural growth, SSA countries rely among others on official development assistance (ODA) (Herdt, 2010). Indeed, two components of agricultural investment are of paramount importance, namely, foreign agricultural aid and public domestic expenditures on agriculture (Alabi, 2014). According to Alesina and Weder (2002), bilateral aid, multilateral aid from international organizations, grants at below-market rates, technical assistance, and debt forgiveness programs are among the international programs to alleviate poverty. Many developing countries depend highly on ODA and SSA is the largest recipient of ODA; this region receives about 35% of total ODA and hosts thirteen out of the twenty largest ODA recipients (Kumi et al., 2017). However, Ssozi et al. (2018) argued on the one hand that until recently, aid for agriculture in volume and in terms of share out of the total aid was declining, and in the other that ODA is neither an automatic panacea nor an immutable curse (constraint), as its effects differ across areas receiving it. It should be noted that according to Knack (2001), the dependence of aid has the potential to undermine the quality of governance and public sector institutions through weakening accountability, encouraging rentseeking and corruption, fomenting conflict over control of aid funds, siphoning off scarce talent from the bureaucracy, and alleviating pressures to reform inefficient policies and institutions.

There is a strand of literature on the role of ODA in boosting agricultural growth, especially in SSA. These studies include Alabi (2014); Ssozi et al. (2018). However, the link between ODA volatility and agricultural growth in SSA remains open. For Chauvet and Guillaumont (2009), ODA volatility may lower and possibly cancel the beneficial effect of aid on economic growth when it is pro-cyclical with regard to exogenous shocks. It may happen that aid disbursements may be different from aid commitments, which gap may affect agricultural productivity growth. This may be due to donor countries' prevailing economic and political conditions, and also to weak institutional structures in recipient countries, and thereby leading to aid unpredictability (Kumi et al., 2017). Therefore, the objective of this paper is to investigate the effect of official development assistance (ODA) volatility on agricultural productivity growth in SSA. Indeed, there is a rising concern about the problems raised by aid volatility (Chauvet and Guillaumont, 2009). This paper contributes significantly to the literature since it aims at providing insights on the extent to which aid volatility hampers the beneficial effects of aid to agricultural productivity growth in the context of SSA. In addition, the paper makes use of rainfall and temperature shocks instead of average temperature and total rainfall.

The remainder of the paper proceeds as follows. Section 2 present a literature review. The methodology used are described in section 3. Section 4 presents the findings as well as their discussion. Finally, section 5 concludes the paper and presents some policy implications.

3 II.

4 Literature Review

Agriculture usually plays a vital role in the economy of every nation that exists. Not only for the reason that it tends to feed the entire population of a country but also in the sense that agriculture correlates and interacts with all the related industries. A country is usually considered to be a social and politically stable nation if it possesses a very stable agricultural basis. In fact agriculture plays a pivotal role in the development of SSA as the major source of income, food, employment, and in its effectiveness in reducing poverty. Most donors aim at promoting poverty reduction, by strengthening agricultural sectors in the recipient economies. One of the reasons of development assistance flows from donor countries to low income developing countries is to achieve the Sustainable Development Goals (SDGs). Agriculture is considered to have an active role in the development process and is often seen as a vehicle to help the poor. Because of the impact of agricultural growth on poverty reduction, this suggests that, agriculture is an aid sector.

The term aid sector signifies the sector of the recipient's economy that the aid activity is designed to assist. Foreign aid can be simply defined as economic assistance provided to a country by another country or organization. In recent years the impact of aid has been more favorably viewed in the literature. Alesina and Dollar (2000) argued that donor's decision on the allocation of foreign aid is guided by political and strategic considerations as much as by the economic needs and policy performance of recipient countries. However, the volatility of foreign aid flows is another issue discussed in the economics literature related to aid. Volatility is a hurdle in achieving sustained economic growth which is an important objective of any economy. The issue is relatively new to the economics literature, especially in relation to agricultural growth. Indeed a key pledge from the Paris Declaration of 2005 was to make aid more predictable. Bulir and Hamann (2003) found that aid inflows are more volatile than domestic revenues, corroborated by their subsequent study ??2008). In the similar vein, Pallage and Robe (2001) found that aid is twice as volatile as real output. Whether or not such aid flows are pro-or anti-cyclical, however, remains controversial; Bulir and Hamann (2003) found that aid tends to move in the same direction as GDP and revenues, while Pallage and Robe (2001) showed that for African countries aid is pro-cyclical differently from recipients outside Africa. Pallage and Robe (2001) observed that aid is highly volatile with an average volatility of about 25% in African recipients and 29.5% in non-African recipients. Aid volatility has been demonstrated to have a negative impact on economic growth (Bulir and Hamann, 2003;Bulir and Hamann, 2008), investment and government expenditure (Hudson and Mosley, 2008a). Celasun and Walliser (2008) argued that unexpected aid shortfalls can force governments to disproportionately cut investment. ??amann (2003, 2008) argued that the volatility of aid is (i) greater than that of government revenue, (ii) increasing over time, and (iii) pro-cyclical (that means that aid flows are inversely correlated with the level of government expenditures). The tendency for aid to be pro-cyclical makes aid-dependent countries more prone to external shocks, reduces the effectiveness of counter-cyclical policy tools (Bulir and Hamann, 2008) and adversely affects the ability of governments to plan expenditure (Bulir and Hamann, 2003). Hudson and Mosley (2008a) found that volatility as a whole reduces growth given the level of aid, but not in a uniform way, differentiating between upside and downside volatility.

Much work of aid volatility has focused on the impact of volatility on the macroeconomic factors. For instance, Lensink and Morrissey (2000) concluded that volatility damages the macroeconomic effectiveness of aid. Arellano et al. (2009) examined the effects of aid and its volatility on consumption, investment, and the structure of production in the context of an intertemporal, two-sector general equilibrium model. They argued that a permanent flow of aid mainly finances consumption rather than investment and that aid volatility results in substantial welfare losses to consumers, equivalent to 8% of the aid budget. Bulir and Hamann (2003) empirical work is based on a sample of 76 countries from 1975 to 2003. They use a Hodrick-Prescott filter to derive aid residuals from a trend. The square of those residuals then measure volatility in a specific year for a given country. Critical in all this is how one scales aid, particularly when comparing volatilities between different variables. Bulir and Hamann (2003) specified aid in US$ and government revenue in domestic currency. Both series were transformed into proportions of nominal GDP, PPP GDP, and constant US dollars per capita. Bulir and Hamann (2003) found that volatility was highest in the countries which are most aid-dependent, which are generally the poorest and most vulnerable. However, in their 2008 paper, they found that the pattern to be more complex, and that both those countries that are little dependent on aid and those that are heavily dependent on aid display high aid volatility relative to government revenue. Rodrik (1990) also analyzed the problems revenue volatility can cause in developing countries, while Mosley and Suleiman (2007) showed that the ability of the recipient country's public sector to implement coherent investment programs and fiscal policies is reduced by aid volatility. Chauvet and Guillaumont (2009) concluded that aid tends to neutralize volatility in export flows and also income volatility, while aid volatility reduces its effectiveness in these respects. They also showed that the higher effectiveness of aid in vulnerable countries is, to a large extent, due to this stabilizing effect. Hudson and Mosley (2008a) in a subsequent paper found no evidence for highly aid dependent countries to have higher volatility. Indeed, they concluded that volatility declines as the aid-revenue ratio increases. But to a large extent they were able to confirm many of the conclusions of **??**amann (2003, 2008), for example that the ratio of aid to government revenue volatility was in excess of one for almost all countries. The volatility of overseas aid was also noted to be severe, in relation to the volatility of domestic revenue, and increasing over time. Hudson and Mosley (2008a) differentiated between positive/upside and negative/downside volatility. Both reduce the impact of aid on growth, but subsequently some of this adverse impact is reversed, although only for positive volatility. With negative volatility there is no such reversal.

Hudson and Mosley (2008b) analyzed the impact of aid volatility on GDP/Gross National Product (GNP) shares of expenditure. Negative volatility reduces investment and government expenditure shares and also the import share. This may be because of the type of aid which is subject to volatility, or because consumers are better able to absorb shocks by drawing on savings and/or borrowing than other agents. The results also suggest a limited ability of governments to rearrange revenue flows to reduce the impact of volatility upon their expenditure priorities. Positive volatility also reduces investment and government expenditure shares, as well as increasing consumers' expenditure share. Some studies have examined other macroeconomic factors such as public sector behavior in developing countries **??**uattara, 2006a, 2006b). Fielding and Mavrotas (2005) distinguished between sector aid and total aid in examining aid volatility in 66 countries over 1975-2004. They built on the conclusion by Levin and Dollar (2005) that aid is more volatile in countries identified as having weak political institutions and historically poor macroeconomic policies. Consistent with this, Fielding and Mavrotas (2008) concluded that institutional quality and macroeconomic stability affect aid volatility, as does reliance on a small number of donors. However, the relative importance of these effects varies across different aid types.

Reflecting this, countries that have recently agreed to International Monetary Fund (IMF) conditionality experience higher total aid volatility, but not higher sector aid volatility. This suggests that having agreed to such conditionality is a sign of weakness in existing macroeconomic policy. They also found that the factors driving up sector aid volatility are different to those impacting on total aid volatility. In addition, a number of individual donors (in particular, Germany, the United States and the European Commission) appear to be associated with relatively high volatility sector aid flows. Neanidis and Varvarigos (2009), using the Creditor Reporting System (CRS) database, found that aid disbursements used for productive sectors have a positive effect on growth, but pure transfers reduce growth. Aid volatility is found to hurt growth, only when aid is used productively, while the volatility of pure aid disbursements is associated with higher growth. Wolf (2007) and Stuckler et al. (2011) focused on the effects of aid volatility on micro targets. Wolf (2007) analyzed the effects of the volume and volatility of aid on education, health, water, and sanitation outcomes. Overall the share of ODA that is provided for education and health seems to have a positive impact on outcomes in these sectors, whereas total aid seems to be negatively associated with these. Aid volatility is associated with better outcomes in sanitation, water, and infant mortality, contrary to expectations. The merits of this paper are in its focus and the use of sector aid as well as total aid. But the research measures aid volatility as the coefficient of variation for total aid during 1980-2002, while the regressions themselves relate to just 2002. Hence, this is entirely different to the concept of volatility as used by most of the literature, and it is not really clear what this is picking up. Stuckler et al. (2011) focused on one of the possible consequences of volatility. They found that for each $1 of development assistance for health, about $0.37 is added to the health system. Evaluating IMF borrowing versus non-IMF borrowing countries reveals that non-borrowers add about $0.45, whereas borrowers add less than $0.01 to the health system. This, they argued, could be because World Bank and IMF macroeconomic policies specifically encourage governments to divert aid to reserves to cope with aid volatility.

Although there is a vast literature on aid effect on economic growth, a very limited number of studies tried to address the relationship between foreign assistance given to the agricultural sector and productivity. Norton et al. (1992) used a total aid variable to look at its effect on agricultural growth. A sub-set of studies look specifically at the effect of agricultural aid on agricultural productivity and finds a strong positive correlation between these two variables **??**Norton et Organization of the United Nations (FAO). They used agriculture value added as the dependent variable and variables related to cross country differences are incorporated in the model to control for their impacts on the dependent variables: GDP per capita, fertilizer consumption, irrigated land, land under cereal production, livestock production index, rural population, sum of exports and imports of goods and services measured as a share of gross domestic product, agricultural machinery (tractors) and crop production index. Their results indicated a positive and statistically significant relationship between growth in the agricultural output and agricultural assistance for rural development.

Alabi (2014) investigated the impact of foreign agricultural aid on agricultural GDP and productivity in SSA. He used secondary data regarding foreign agricultural aid, agricultural GDP, and productivity indicators from 47 SSA countries spanning 2002-2010 and employs a Generalized Method of Moments (GMM) framework. The econometric analysis suggests that foreign agricultural aid has a positive and significant impact on agricultural GDP and agricultural productivity at 10% level of significance. The study also reveals that bilateral foreign agricultural aid influences agricultural productivity more than multilateral foreign agricultural aid and that multilateral foreign agricultural aid influences agricultural GDP more than bilateral foreign agricultural aid. Scaling up foreign agricultural aid will increase its impact on agricultural productivity and its contribution to the economy of SSA, and sectorial foreign agricultural aid allocation should give priority to factors that will enhance this productivity.

Ssozi et al. (2018) used the system two-step GMM to examine whether ODA for agriculture and rural development is helping to boost agricultural productivity, through a Cobb-Douglas production function. The dataset is made up of 36 SSA countries, covering the 2002-2015 time periods. They found that, there is a positive relationship between development assistance and agricultural productivity in general. However, when broken down into the major agricultural recipient sectors, there is a substitution effect between food crop production and industrial crop production. Better institutions and economic freedom are found to enable agricultural productivity growth, and to increase the effectiveness of development assistance.

There has always been a debate about the empirical correlation between aid and economic growth, and agricultural productivity. The association could be spurious if aid is increasingly flowing into countries where agricultural productivity has been already increasing as a result of another factor. Fluctuations in aid inflows can result in instability of employment, changes in government budgets and uncertainty about the degree to which resources will be utilized in the future. All this has welfare consequences. Aid effectiveness literature primarily follows two main streams. Earlier studies mostly focused on the effect of aggregate aid on overall economic performance. Later studies concentrated on the effect of sector specific aid on sectoral and aggregate economic performance as comprehensive sectoral aid data became more available from bilateral and multilateral aid agencies. These studies investigated the possibility that the effect of different kinds of aid may be of importance for understanding the macroeconomic effect of aid in aid recipient countries. The literature on the nexus between foreign aid and agriculture has not assessed whether ODA for agriculture is relevant in increasing productivity in agriculture.

This paper switches the attention from the macroeconomic effects of aid unpredictability by linking aid volatility and agricultural productivity.

5 III.

6 Material and Methods

7 a) Specification of the model

This study makes use of an agricultural growth model as it aims to investigate the impact of ODA volatility on agricultural productivity growth, following the existing literature on the subject summarized in the previous section. Consider the following Cobb-Douglas agricultural production function:?? = ???? ?? ?? ?? ???? ?? ?????? ??

Where ?? is the agricultural value added, ?? refers to the level of capital used during the production process, ?? denoted the level of labor, ???? is land and ?????? refers to ODA to the agricultural sector. The Cobb-Douglas production function is chosen due to its flexibility compared to other production functions such as the transcendental logarithmic production function (translog production function) and the linear production function.

In this specification, ODA is considered as a form of input which contributes directly to agricultural growth. Dividing the two sides of (1) by the number of agricultural workers yields the per capita agricultural production function specified as follows:?? = ???? ?? ???? ?? ?????? ?? .

In (2) the variables are expressed in per capita. Linearizing (2) through making use of the natural logarithm, and adding the error term leads to:?????? = ?????? + ???????? + ?????????? + ???????????? + ??

Where ?? is the error term. This study is particularly interested in the effect of ODA volatility on agricultural productivity growth. Therefore, a variable capturing this volatility is added to (3). ODA volatility is captured in this study by the difference between ODA disbursements and commitments. As climate factors are important for agricultural activities due to the mostly rain-fed nature of the agriculture in SSA countries, rainfall and temperature must be included in the equations. We use rainfall and temperature shocks instead of average temperature and total rainfall. Rainfall and temperature shocks are computed as the deviation of mean annual temperature and total annual rainfall of each year from the historical mean annual rainfall and temperature of the country. The historical period used in the paper is the 1981 -2010 reference period set by the World Meteorological Organization (WMO). Thus, we have the following specification:?????? = ?????? + ???????? + ?????????? + ???????????? + ?????????????????????? + ?????????? + ?????????? + ??.

Capital is captured by government expenditures in the agricultural sector. We include the base year value of agriculture value added per worker (the value in the first year of the sample) in the regression. Thus the coefficient associated with this variable is expected to be negative, and thereby will relate to the speed of convergence. Owing to this, we prefer to estimate a random effects model, as fixed effect estimation is not possible with the presence of this variable. It is worth noting that we thought about the non-linearity between aid volatility and agricultural productivity growth. Indeed, we explore the threshold effect of aid volatility on agricultural productivity growth via a Fixed-effect panel threshold model (Hansen, 1999;Wang, 2015) under the assumption that when ODA volatility exceeds a given threshold, ODA ceases to affect agricultural productivity growth. However, the threshold appears to do not be significant rejecting the non-linear model. Therefore, the estimated model is specified as follows:?????? ???? = ?????? + ???????? ???? + ?????????? ???? + ???????????? ???? + ?????????????????????? ???? + ?????????? ???? + ?????????? ???? + ??????????????????????_?? ???? + ?? ????

Where ?? = 1, ? , ?? and ?? = 1, ? , ??.

8 b) Data

The data used in this study are from three sources. Data on ODA for the agricultural sector are collected from the Organization for Economic Cooperation and Development (OECD) Statistics (CRS). These data are related to ODA commitments and ODA disbursements. As aforementioned, ODA volatility is computed as the gap between disbursements and commitments and is in the form of a ratio. Data related to government expenditures in the agricultural sector are the Food and Agriculture Organization of the United Nations (FAO) database. The remaining data are collected from the World Development Indicators (World Bank, 2018). All variables except land which is expressed in hectares are in US $ constant. We use a panel data ranging from 2002 to 2015. This period is chosen because ODA disbursements are available from 2002, and therefore we are constrained by this availability period. Thirty four SSA countries are accounted for in the estimations due to data availability on the study period.

9 IV. Empirical Results and Discussion

Table 1 presents the summary statistics of the variables before turning to the estimation results. The average agricultural value added per worker amounted to US$ 1,717.89 over the period from 2002 to 2015, which is higher compared with the US$ 1.25 international daily poverty line. However, there are disparities across countries as indicated by the standard deviation of 2,154.10, and the minimum of 200.30 which is far below the maximum of 9,824.97. Land use per worker is also unevenly distributed across SSA countries of the sample (average of 16.21 ha and a minimum and a maximum of 0.05 ha and 152.24 ha, respectively). The extent of climate shocks differs across space and over time. On average, over 2002-2015 all countries in the sample have experienced positive rainfall and temperature shocks. This indicates that on average the annual rainfall is greater than the historical mean, denoting more water. As for temperature, this reveals that the average temperature has increased, suggesting

that this may be detrimental to the agricultural sector. Disparities in ODA per worker are also observed within SSA countries included in the sample. Actually, the average ODA per worker amounted to US$ 14.48 over the study period, with a minimum of 0.03 and a maximum of 310.97. Gaps are observed between ODA commitments and ODA disbursements. On average, ODA disbursements are higher of about 62% to ODA commitments (on average the upside volatility outweighing the downside volatility). The minimum gap is about -95%, while the maximum gap amounts to 6,931%. As for government expenditures in the agricultural sector per worker, its average amounts to US$ 5,720.94. all the countries experienced at least once downside ODA volatility (as shown by the minimum value which is negative for all countries), none of them have recorded only this type of volatility (the maximum value is positive for all countries). The estimation results will reveal the effect of this volatility on the agricultural productivity growth in SSA. 3. Three equations are estimated depending on the inclusion of ODA and its volatility. Model 3 is the preferred estimation as it includes both ODA and its volatility. The signs of the estimated parameters are consistent in the three equations, except for ODA. In the three specification the coefficient associated with the initial value of agricultural value added per worker is positive and highly significant. Therefore, the finding suggests that there is no convergence in agricultural productivity growth in SSA during the period of analysis. Actually, all the countries are not allocating at least 10% of the national budget to agriculture as they have committed themselves in Muputo in 2003. The finding may perhaps be due to the study period covering 2002-2015. Land appears to do not significantly influence the agricultural value added per worker in SSA, although its associated coefficient has the expected positive sign. Similarly, rainfall and temperature shocks do not influence significantly the agricultural productivity growth. The finding related to the effect of rainfall and temperature shocks is simply about the average effect on all countries included in the sample over the study period. In addition, the effect may be different when it comes to the individual countries.

The findings indicated that although the effect of ODA on agricultural productivity growth in SSA countries is positive, it is not significant. This finding is not in line in terms of significance with previous literature (e.g., Kaya et al., 2008;Alabi, 2014;Ssozi et al., 2018) which indicates that ODA affects positively and significantly agriculture in SSA. The non-significance of the positive effect of ODA may be due to the study period. As for ODA volatility, it has a negative and significant effect on agriculture value added per worker, indicating that this volatility is destabilizing for the agricultural sector in SSA countries. This finding is consistent with our expectation as volatility damages the macroeconomic effectiveness of aid (Lensink and Morrissey, 2000). Thus, ODA volatility is detrimental to agricultural productivity growth in SSA. Nevertheless, this finding is not consistent with that of Wolf (2007) that found that aid volatility is associated with better outcomes in terms of sanitation, water, and infant mortality. It should be noted that the summary statistics reveal that, on average, the upside volatility outweighs the downside volatility over the study period. So, even the upside volatility is not, on average, beneficial to agricultural productivity growth in SSA. Nonetheless, the situation is not uniform in all countries; some countries experience negative volatility while others a positive one and the effect of ODA volatility may vary across countries. Government expenditures per worker appear to be very important in boosting agricultural productivity growth in SSA. The result reveals that a one per cent increase in government expenditures per worker leads to a 0.13 per cent increase in agricultural value added per worker, ceteris paribus. Therefore, this result indicates the effectiveness of government expenditures in the agricultural sector of SSA countries.

10 V. Conclusion and Policy Implications

Support to the agricultural sector is of paramount importance for poverty reduction in SSA. Owing to that, this paper investigates the effect of aid and its volatility on agricultural productivity growth in SSA countries. The empirical evidence is based on a random effects model, using data on 34 SSA countries for the period 2002-2015. The summary statistics indicates that, on average, over the period of study, the upside volatility outweighs the downside volatility of aid for the agricultural sector. The estimation results show that government expenditures in the agricultural sector, and the initial value of agricultural value added have a positive and significant effect on agricultural productivity growth. ODA volatility is found to be detrimental to agricultural productivity growth. Climate shocks appears to do not affect significantly agricultural productivity growth in SSA. Owing the positive sign of the coefficient associated to the initial value of the agricultural value added per worker, the findings reject the hypothesis of convergence between SSA countries included in the study over 2002-2015. The findings suggest that SSA countries partners may continue helping in terms of boosting the agricultural productivity growth through ODA and reduce the gap between ODA disbursements and ODA commitments. However, SSA countries have to used ODA to attain the objectives set and eliminate corruption inherent to the utilization of ODA. Based on the results, governments must increase expenditures allocated to the agricultural sector in order to improve its productivity and at the end of the day structurally change agriculture in SSA countries in line with the Malabo declaration on accelerated agricultural growth and transformation for shared prosperity and improved livelihoods of 2014. Alternative ways of capturing ODA volatility may be used for robustness checks. Moreover, disaggregated ODA may be used to capture the specific effects. Furthermore, alternative specification may be used.

Figure 1:

1

Variables	Observations	Mean	Std. Dev.	Min	Max
Agricultural value added per worker	490	1,717.89	2,154.10	200.30	9,824.97
ODA	490	14.48	32.88	0.03	310.97
ODA volatility	490	0.62	4.25	-0.95	69.31
Land per worker	490	16.21	34.56	0.05	152.24
Government expenditures	330	5,720.94	11,481.43	53.05	62,323.11
Rainfall shock	490	26.39	116.21	-568.45	473.07
Temperature shock	490	0.27	0.33	-0.57	1.57

Figure 2: Table 1 :

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Figure 3: Table 2

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Countries	Observations	Mean	Std. Dev.	Min	Max
Benin	14	0.003	0.56	-0.70	1.37
Botswana	14	-0.004	0.38	-0.93	0.53
Burkina Faso	14	0.04	0.45	-0.82	0.96
Burundi	14	-0.29	0.32	-0.62	0.55
Cabo Verde	14	0.93	1.31	-0.89	4.60
Central African Republic	14	1.68	2.46	-0.72	9.51
Congo, Dem. Rep.	14	-0.23	0.22	-0.70	0.06
Congo, Rep.	14	0.40	0.68	-0.85	2.10
Côte d'Ivoire	8	0.15	0.69	-0.55	1.50
Ethiopia	14	-0.06	0.47	-0.56	1.33
Gambia, The	14	1.05	1.59	-0.82	4.73
Ghana	10	0.08	0.64	-0.80	1.49
Guinea-Bissau	14	0.24	0.71	-0.74	1.97
Kenya	14	-0.13	0.37	-0.71	0.43
Lesotho	14	0.41	0.99	-0.60	2.82
Liberia	14	0.35	1.80	-0.96	5.70
Madagascar	14	0.10	0.36	-0.35	1.12
Malawi	14	0.13	0.66	-0.63	2.15
Mali	14	-0.12	0.39	-0.79	0.51
Mauritius	13	10.32	18.17	-0.95	69.31
Mozambique	14	0.04	0.40	-0.65	0.67
Namibia	14	0.09	0.61	-0.90	1.46
Nigeria	14	0.51	1.89	-0.86	6.30
Rwanda	14	-0.11	0.29	-0.62	0.36
Sao Tome and Principe	14	0.81	1.61	-0.85	5.88
Senegal	14	-0.02	0.37	-0.82	0.56

Figure 4: Table 2 :

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Variables	Model 1	Model 2	Model 3
ODA per worker	-0.002		3.10e-04
	(0.01)		(0.01)
ODA volatility		-0.002***	-0.002**
		(0.001)	(0.001)
Land per worker	0.05	0.05	0.05
	(0.04)	(0.04)	(0.04)
Rainfall shock	2.61e-05	2.62e-05	2.61e-05
	(5.2e-05)	(5.16e-05)	(5.18e-05)
Temperature shock	0.04	0.04	0.04
	(0.04)	(0.04)	(0.04)

Figure 5: Table 3 :

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