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Abstract

One of the key economic development challenges facing Sub-Saharan Africa (SSA) is its low agricultural productivity. Governments, donors, and foreign investors have underinvested in African agriculture even though research evidence shows that higher agricultural productivity would boost economic growth and poverty reduction. Solutions to the problem require a number of interconnected strategies, including, but not limited to, research on seeds and inputs, extension services, rural development, credit, institutional, and trade and price stabilization policies. We use the system two-step Generalized Method of Moments to examine whether official development assistance (ODA) for agriculture and rural development is helping to boost agricultural productivity. We find a positive relationship between ODA and agricultural productivity. However, when broken down into the main agricultural ODA recipient sectors, there is a substitution effect between food crop production and industrial crop production. While there exists a positive relationship between ODA for industrial and export crops output per worker (agricultural productivity), ODA for food crops has a negative relationship. Better public institutions and economic freedom are also found to enable agricultural productivity growth and to increase the ODA effectiveness. We correct the results for spurious correlation assuming that more ODA might be allocated where agricultural productivity is already increasing due to some other factors. Concerning the determinants of ODA allocation, we find that the allocation of ODA for agriculture is primarily determined by agricultural need, and that the expected effectiveness increases the ODA receipts. Finally, there is a weak ODA-led structural economic change effect in SSA. Labor released from agriculture to the urban sector(s) has a positive market effect on agriculture but is not engendering significant structural economic transformation.

JEL Classification: F35; F50; Q10; O10; O55
Keywords: Foreign aid; Agriculture; Development; Africa

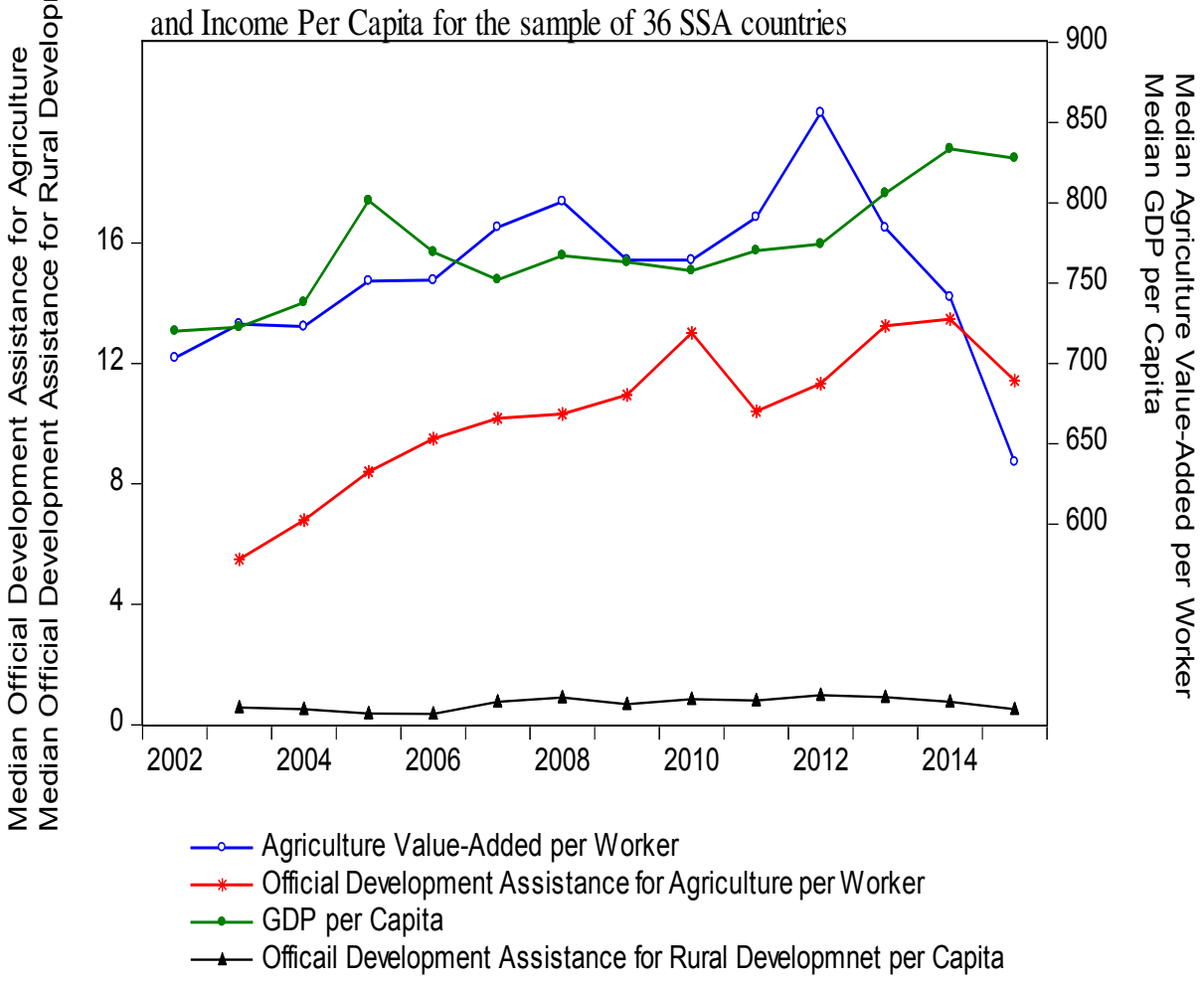
1. Introduction

Previous research shows that agriculture plays a pivotal role in the development of the Sub-Saharan Africa (SSA) as the major source of income, food, employment, and in its effectiveness in reducing poverty. For instance, the African Development Bank Group (AfDB) Feed Africa Strategy (2016) disclosed that in 2014 over 60 percent of the people in Africa lived in rural areas and relied on agriculture for their livelihoods, and that women in Africa made up at least half of the agricultural labor force. According to Mellor (2001), Dercon and Christiaensen (2005), Christiaensen, Demery, and Kuhl (2010) growth in agriculture has a larger poverty-reducing effect than growth in nonagricultural sectors, especially among the households below the poverty line. They find that both consumption and employment increase if households use fertilizers to increase farm productivity. Others who find agriculture productivity growth to have a greater effect on poverty reduction than industrial productivity growth include: Timmer (1999), Ravallion and Datt (1999), and Dio, Hazell, Resnick, and Thurlow (2007). Despite its crucial role in development, governments, donors, and foreign investors have underinvested in African agriculture, and the sector continues to have low levels of productivity.

Until recently, especially over the 1980s and early 1990s, the volume and share of total aid for agriculture was declining. The Food and Agriculture Organization of the United Nations (FAO), reports that in 2014 donors provided only 5 percent of total development assistance to projects in the Agriculture, Forestry and Fishing sector, down from 9 percent in the mid-1990s. However, since 2001 there has been a renewed donor interest in agriculture especially in Africa. Using the median values for the period 2002-2015, Figure 1 demonstrates that official development assistance for agriculture per worker (ODAAPW) for the 36 African countries in our sample had been increasing from 2003 to 2013 when it abruptly fell even when agriculture

value-added per worker had been declining since 2012. Figures 1 and 2 also show that between 2002 and 2013, while sustaining a positive trend, ODAAPW was countercyclical: it increased when agriculture value-added per worker (AVPW) decreased, but slowed down when AVPW regained.

Figure 1. Median values of ODA for Agriculture, Agriculture Value-Added per Worker, and Income Per Capita for the sample of 36 SSA countries



One possible explanation of the decline in agricultural value-added is that Africa has been the last region to embrace the Green Revolution, resulting into the lowest adoption of modern varieties of crops such as rice, wheat, maize, sorghum, cassava, and potatoes, which are widely grown across the continent (Evenson and Gollin, 2003). The AfDB Feed Africa strategy also points out that food imports by Africa are expected to grow from US$35 billion in 2015 to over

US$110 billion by 2025, while the number of the undernourished is projected to rise from about 240 million in 2015 to 320 million by 2025. One of the targets of the United Nations Sustainable Development Goals (SDGs) after 2015 is ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture. To achieve these goals there is a felt need for a concerted effort by both public and private agents. The Green Revolution in Asia was supported by government interventions and subsidies. Even when some of these policies were distortionary, as in the case where fertilizer subsidies reduced prices to 25 percent of their world market price (Gonzales, Kasryno, Perez, Rosegrant, 1993; Dethier and Effenberger, 2012), thy still pulled many Asian countries out of abject poverty.

However, policies to increase government investment in agriculture have been less successful in SSA. The Maputo-Declaration (2003), required that nations of the African Union allocate 10 percent of the total government budgetary resources to agriculture and rural development. A report by the New Partnership for Africa's Development (NEPAD), reveals that only 9 of 44 countries had met the 10 percent target by 2013. Under the Malabo Declaration of 2014 the African Union member states recommitted to the 10 percent goal. Table 1 gives a snapshot of the public investment in agriculture in SSA. The Agriculture Orientation Index for Government Expenditure in Tab1e 1 is far less than 1.0, implying that governments in SSA are generally giving far less prominence to agriculture than its contribution to the economy. Whereby an index of 1.0 (or higher) implies that governments are giving as much (more) prominence to agriculture as (than) its contribution to the economy. For this reason the World Development Report, *Agriculture for Development* (World Bank, 2007),and IAASTD's (2009) *Agriculture at a Crossroad*, both claim that agriculture has been neglected by governments as well as donors.

Table 1: A snapshot of Public Expenditure in Agriculture in Sub-Saharan Africa (2001-2015)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ACGE	2.78	2.86	2.48	2.71	3.42	3.34	3.74	2.42	2.92	2.48	2.42	2.23	2.08	2.28	1.72
AGDP	12.19	12.23	16.26	14.02	13.75	14.12	14.30	14.89	15.72	14.04	13.91	14.06	13.83	9.84	13.23
AOIGE	0.23	0.23	0.15	0.19	0.25	0.24	0.26	0.23	0.19	0.18	0.17	0.16	0.15	0.23	0.13

Data Source: Food and Agriculture Organization of the United Nations
ACGE≡ Agriculture share of Central Government Expenditure; AGDP≡ Agriculture share of GDP; AOIGE≡ Agriculture Orientation Index for Government Expenditure, which provides a ratio of the agriculture share of central government spending to agriculture's contribution to GDP. Governments with an AOIGE greater than 1 give more prominence to agriculture than its contribution to the economy while those with an AOIGE less than 1 give more prominence to non-agricultural sectors.

Foreign Direct Investment (FDI) into agriculture is also very much limited. According to Onyeiwu and Shrestha (2004), Cleeve (2008), Asiedu (2006, 2011), and Kolstad and Wiig (2012), it is the abundance of natural resource endowments, particularly oil, not agriculture, that attracts the most FDI flows into Africa. During the State of the Africa Region conference on April 22, 2017, it was revealed that of the total FDI inflow to Africa only 0.04 percent goes into agriculture – a percent that corroborates the FAO report that from 1997 to 2011, FDI inflows to agriculture, forestry and fishery remained below 0.5 percent of total FDI.

In the light of the goals of the African Union, underinvestment in the agricultural sector, and the threat posed by low agricultural productivity per worker in Africa, this paper seeks to find out whether the ODAAPW has been effective at increasing agricultural productivity in SSA. Earlier studies have examined the role of foreign aid in general or aid to agriculture in economic growth and poverty reduction with mixed results (Kaya, Kaya and Gunter, 2012, 2013; Mavrotas, 2003, 2003; Clemens et al., 2004). Indeed the link between foreign aid and economic growth remains a hot debate (see, e.g., Easterly, 2006; Moyo, 2009; Deaton, 2013). This paper contributes to the debate in a number of ways including the following four ways. First, we break down the official development assistance (ODA) for agriculture per worker and focus on its

proximate effect on agriculture value-added per worker. We examine the leading ODA recipient sectors within agriculture, and assess how they are contributing to agriculture value-added per worker. We are doing this because ODA for agriculture may increase economic growth and reduce poverty depending on a number of other factors outside the agricultural sector, including the percent of GDP originating from agriculture and rural population dynamics, for instance.

Second, since ODA is channeled through the government, we investigate whether government effectiveness enables ODAAPW to be more effective. Some of the most commonly cited factors in the literature that makes aid ineffective are corruption (Svensson, 2000; Asongu, 2012) and weak institutional quality of recipient countries (Burnside and Dollar, 2000; Asongu and Nwachukwu, 2016). We also examine the effects of economic freedom on agricultural productivity. Most of the agricultural production in SSA is by small-holder farmers whose production choices are influenced by the business climate in addition to government policies.

Third, there has always been a debate about the empirical correlation between aid and economic growth and/or 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. We therefore investigate the assertion for any suggestive evidence of whether official development assistance for agriculture is flowing into countries where agricultural productivity is already improving for reasons other than effective aid programs. Is agricultural ODA chasing success? An increasing flow of aid to countries where agricultural productivity is already increasing would be a hidden form of ineffectiveness.

Fourth, since SSA economies are heterogeneous, their growth will inevitably involve changes in the relative importance of the economic sectors. Hence we also assess the effectiveness of ODA for agriculture via its structural change effect. The rest of the paper is

structured as follows. Section 2 provides theoretical highlights and reviews recent literature. The data and methodology are covered in Section 3, while Section 4 presents and discusses the results. We conclude in Section 5 with future research directions.

2. Theoretical highlights and brief literature

This section discusses three main strands of literature: (a) the theoretical underpinnings of the relevance of development assistance; (b) contemporary foreign aid studies in the light of the post-2015 development agenda; and (c) some recent agricultural literature on agro-allied industrialization. We substantiate the three strands in a chronological order. First, the concern about whether foreign aid has positive externalities on the development of recipient nations is traceable to the two-gap model developed by Chenery and Strout (1966), which is one the most influential theoretical foundations of the relevance of development assistance in the catch-up process of developing countries. The theoretical underpinning of Chenney-Strout model maintains that developing countries are confronted with the lack of savings and "export earnings" may be not appropriate for enhancing investment. Despite apparent shortcomings in its underlying postulations, the model provided the basis for empirical papers on development assistance in the past decades (Easterly, 1999; Masud & Yontcheva, 1999). In essence, the Solow- and Harrod-Domar growth models allow for the idea that aid is necessary to stimulate investment and to reduce inequality. These theoretical underpinnings are consistent with the need to reinvent foreign aid for more inclusive and sustainable development (Asongu, 2016).

Second, the theoretical linkages between development assistance mechanisms and development outcomes in poor countries are founded on some perspectives on the poverty tragedy in Africa and on the effectiveness of foreign aid in boosting economic development which have been documented by Asongu & Nwachukwu (2017). In response to the growing

poverty levels in Africa, Kuada (2015) has proposed a new development paradigm based on shifting from "strong economics" (or structural adjustments policies) to "soft economics" (or human capability development). The conception of agriculture value-added per worker (AVPW), which is a key notion in this study, is consistent with this paradigm shift as well as theoretical proposition of Asongu and Jellal (2016) on channeling foreign aid through mechanisms that decrease the tax burden borne by the private sector. It is also important to note that Kuada's (2015) 'paradigm shift' for elucidating development outcomes, reducing unemployment and eliciting inclusive development is in accordance with a new stream of African development literature which has focused on the reinvention of foreign aid to meet the challenges of sustainable development goals (see Simpasa et al., 2015; Jones et al., 2015; Page &Söderbom, 2015; Page & Shimeles, 2015).

Third, recent agricultural literature on agro-allied industrialization for development in Africa has largely focused on *inter alia*: the effect of irrigation on food production (Nonvide, 2017); improving productivity via warehousing systems (Katunze et al., 2017); gender differences among subsistence farmers and the willingness to undertake agribusiness (Coker et al., 2017); the role of the female farmer entrepreneurs in poverty reduction (Nukpezah & Blankson, 2017); multinationals in Africa's food retail businesses (Nandonde & Kuada, 2017); transmission of international food prices (or imported inflation) to African markets (Fiamohe et al., 2015); the role of value chains in agricultural business (Ndyetabula et al., 2016) and the composition of agricultural productivity (Mohamed et al., 2016). Noticeably missing is the fact that the literature on the nexus between foreign aid and agriculture has not assessed whether ODA for agriculture and rural development is relevant in increasing productivity in agriculture.

3. Data description and estimation methodology

Following De Janvry and Sadoulet (2016), a general production function for agriculture may be specified as follows: $Y = AF(K, L, N)$, where Y is agricultural output, A is total factor productivity (technology) which is land saving and/or labor saving, K is capital, L labor, and N is land. These factors of production represent the broadest channels through which official development assistance (ODA) can be used to enhance agricultural productivity. The dataset is made up of 36 SSA countries, covering the 2002-2015 time period. The country sample is determined by data availability, especially data on official development assistance (ODA) for agriculture. The data for the leading recipient sectors in agriculture are sourced from the Organization for Economic Co-operation and Development (OECD) Creditor Reporting System (CRS) database, gross disbursements. The key recipient sectors are: agricultural development, agricultural policy and administrative management, food crop production, industrial crops or exports crops, agricultural inputs, agricultural co-operatives, agricultural education or training per worker, and ODA for rural development. All the ODA flows are real gross disbursements from all donors, and have been converted into the recipients per worker in the agricultural sector. Table 2 reports the summary statistics of the key variables.

Table 2: Descriptive Statistics (US dollars)

Variable	Obs	Mean	Std. Dev.	Min	Max
Agriculture value-added per worker	495	1314.79	1657.53	196.41	9745.69
GDP per capita	518	1345.37	1628.94	193.86	7627.85
ODA for agriculture per worker	462	19.70	34.51	-13.77	321.95
ODA for rural development per capita	461	1.22	1.88	-0.491	17.97
ODA for agricultural policy and administrative management per worker	451	3.06	7.85	-3.38	113.06
ODA for agricultural development per worker	452	3.51	6.16	-2.32	94.05
ODA for agricultural inputs per worker	330	0.520	1.21	-1.60	9.38
ODA for food crop production per worker	392	1.17	4.16	-0.620	76.1
ODA for industrial crops/export crops per worker	250	2.69	12.51	-0.217	123.6
ODA for agricultural co-operatives per worker	338	0.264	0.404	-0.339	3.68
Government Effectiveness	518	-0.734	0.549	-1.81	0.73
Control of corruption	518	-0.593	0.571	-1.51	1.24

We preface our data description with historical portrayals of key variables in Figures 1 and 2. As stated above, during this time period there was a discernible upward trend in per worker agricultural value-added per worker, ODA for agriculture per worker, and GDP per capita. However, the rate of increase was slow. Moreover, GDP per capita rose and fell sharply during the 2003-2005 years. Agricultural value added per worker peaked circa 2007, and recovered rapidly through 2013 before it collapsed from there onwards. The collapse came after a decline in ODA per agriculture per worker with a time lag of about two years. When the latter started to go up again, the former continued to fall, which seems to suggest that agricultural value added depended on ODA for agricultural per worker. However, ODA for rural development per capita experienced modest increases between 2006 and 2012, after which it fell to its initial levels. There appears to be a weak relationship between GDP per capita and agricultural value added per worker on one hand, and between GDP per capita and ODA for rural development on the other.

Figure 2: Median values of select areas of official development assistance for agriculture (36 SSA countries)

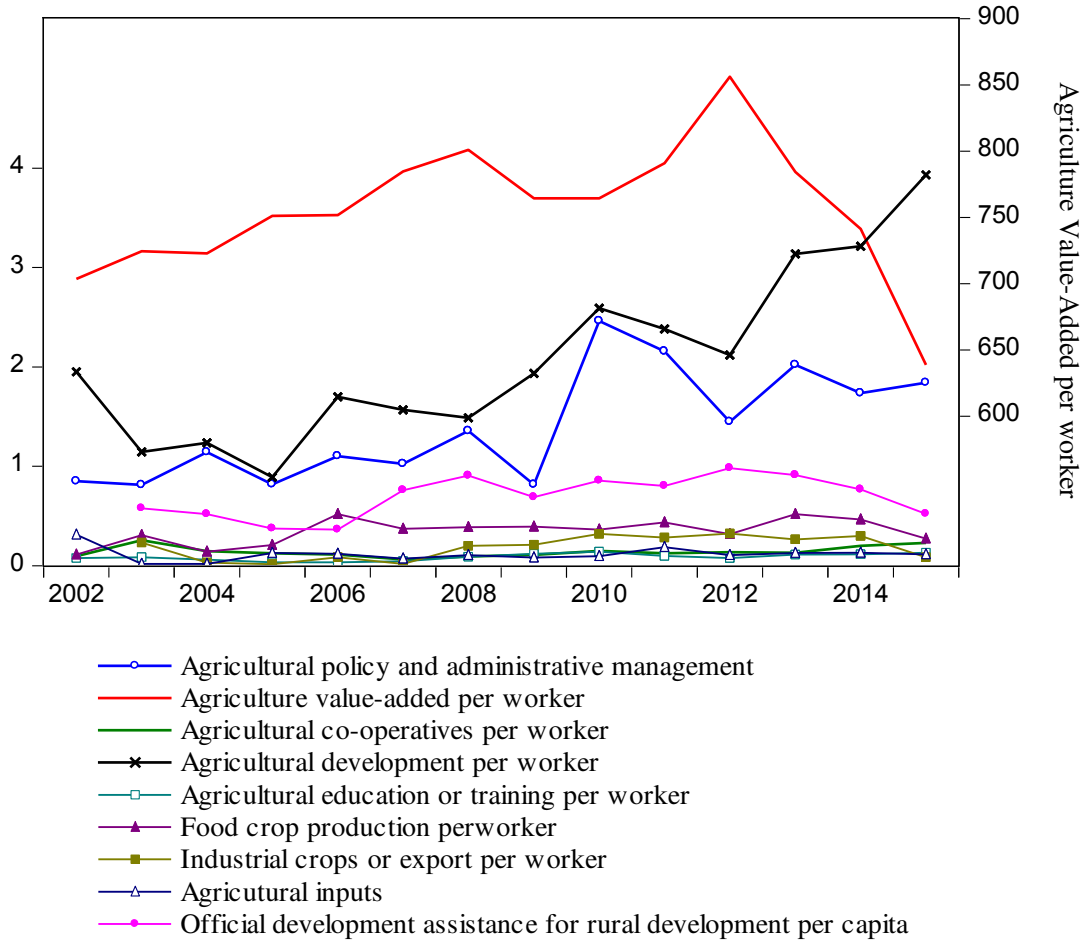


Figure 2 disaggregates ODA for agriculture by sectors of destination. The leading agricultural sector recipients of ODA are: agricultural development per worker and agricultural policy and administrative management. There have been modest increases in ODA for industrial crop production and agricultural education. From about 2002 to 2012, agricultural value added appears to be associated with ODA. What are the specific relationships among all these variables? What explains the dramatic fall in agricultural value added even after ODA started to increase again? The answers to these and similar questions motivated the results in Tables 3-5.

The other control variables are: government effectiveness and control of corruption extracted from the Worldwide Governance Indicators. Since ODA is mostly channeled through

the government, the governance indicators capture the extent to which public institutional quality can enhance or cripple policy interventions. At the same time, the effectiveness of ODA does not depend only on the public institutions, it is also affected by a country's business climate. We use the following components of economic freedom from the Heritage Foundation to examine the quality of business climate: business freedom, trade freedom, tax burden, and property rights. Urban population percent of the total population and the GDP per capita are included in the structural transformation regression, where the former controls for demographic changes. These variables are obtained from the World Development Indicators to control for the level of economic growth.

Islam (2011) provides a comprehensive factual and analytical review of foreign aid for agriculture for the 1970-2008 time period. A key observation from the review is that foreign aid to industrial production, and agriculture, forestry and fishing have declined since 1980. Aid to industry, mining and construction has been trending downwards from 1973 onwards. Consequently all aid (bilateral and multilateral) fell since 1981, although there was some revival beginning 2005. Islam gives five reasons for the decline: One, there has been change in the international consensus over the strategy for poverty reduction. The new understanding is that support to agriculture is but one way of reducing poverty. Among others is aid to the social and physical infrastructure in rural areas. Two, new demands brought about by special events like conflicts have pulled foreign aid to non-development uses such humanitarian assistance. Three, project incompletions and inefficiencies have created a disincentive among donors. Four, institutional changes have benefitted different sectors differently so that some donors tend to aid success than need. Finally, aid for agriculture has generally declined as the share of agricultural output to GDP has fallen.

Islam's study informs this paper greatly except in two important respects. First, it focuses on total (bilateral and multilateral) foreign aid. We concentrate on ODA for agriculture. Islam also assumed raising agricultural productivity, which is not always the case in SSA. Therefore, we use the two-step system Generalized Method of Moments, GMM (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998; Roodman, 2009ab) to equation (1) estimates the association between ODA for agriculture and agriculture value-added per worker.

$$\ln(agvapw)_{it} = \sum_{a=1}^{c} \beta_1 \ln(agvapw)_{it-a} + \sum_{d=1}^{f} \beta_2 \ln(odagri)_{it-d} + \sum_{g=1}^{j} \beta_3 \ln(odaruraldev)_{it-g} + \delta_i + \varepsilon_{it}$$

$$\mathrm{E}[\delta_i] = E[\varepsilon_{it}] = E[\delta_i \varepsilon_{it}] = 0, \qquad (1)$$

where *agvapw* stands for the agriculture value-added per worker, $odagri$ is the total ODA for agriculture; $odaruraldev$ is the ODA for rural development; $\delta_i$are the unobserved time-invariant country-specific effects, and ε_{it} are the observation error terms. Total ODA for agriculture is further broken down into the leading recipient sectors to find out what sectors have a significant effect on agriculture value added per worker. Given the underinvestment in agriculture one would expect that both ODA for agriculture and for rural development would increase agricultural productivity. However, since most of this ODA is channeled through the government, corruption and government ineffectiveness can choke it. We use equation (2) to assess the effect of ODA controlling for government effectiveness *(goveff)* and the country score on control of corruption.

$$\ln(agvapw)_{it} =$$

$$\sum_{a=1}^{c} \beta_1 \ln(agvapw)_{it-a} + \sum_{d=1}^{f} \beta_2 \ln(odagri)_{it-d} +$$

$$\sum_{g=1}^{j} \beta_3 \ln(odaruraldev)_{it-g} + \beta_4 \ln(goveff)_{it} + \beta_5 \ln(odagri) * \ln(goveff)_{it} + \delta_i + \varepsilon_{it}. \qquad (2)$$

We control for government effectiveness both directly and directly. We also exogenously split the data into two using the median values of government effectiveness, and run two regressions from equation (2). First, when government effectiveness is below the median value. Second, when government effectiveness is above the median value. If the quality of institutions affects the effectiveness of ODA, one would expect the second regression to have a more significant positive effect than the first.

There has always been a debate about a possibly hidden ineffectiveness of ODA. It is often assumed that donors want to allocate ODA to places where the need is greatest, but also where it is likely to be effective in reducing a problem. For instance, conflict areas have the greatest need, but the unrest makes ODA very ineffective. On the other hand, allocation of ODA to politically stable regions, with improving institutions, is likely to be a lot more effective even when they don't have the greatest need. Which of the two wins more ODA: Need or effectiveness? If effectiveness wins, then ODA would correlate with unobservable factors that affect agricultural productivity. The GMM estimation technique is one way of addressing that endogeneity. In order to unmask the possibility of hidden ineffectiveness we seek to find out whether ODA for agriculture is either negatively associated with more need or is positively associated with unobserved factors that increase agriculture value-added per worker irrespective of aid. We model equation (3) with ODA for the future period as the dependent variable, and volatility in agricultural productivity as the primary independent variable. This specification can give us two insights: One, about endogeneity. Two, about the determinants of ODA allocation for agriculture, that is,

$$\ln(odagri)_{it+1} = \beta_1 \ln(odagri)_{it} + \beta_2 \ln(agvapwvolatility)_{it} + \beta_3 \ln(institutions) + \beta_4 \ln(agvapwvolatility)_{it} * \ln(institutions) + \delta_i + \varepsilon_{it} \quad (3)$$

4. Estimation results and discussion

Table 3 reports results from a number of regressions of agriculture value-added per worker on ODA for agriculture. The statistical significance of lagged agriculture value-added per worker is quite high, indicating persistence in agricultural productivity. For example, agricultural value added, lagged by one year, has a marginal impact on current year agricultural value added of 1.033, implying a long-run multiplier of 33.33 [= 1/ (1-1.033)]. *Ceteris paribus*, agricultural value added is inelastic with respect to agricultural aid per capita. This finding is inconsistent with Alabi's (2014) result, but most likely because the latter considered all aid, not ODA for agriculture as such. Similarly, in absolute terms, the coefficient of elasticity of agricultural value added relative to ODA for rural development per capita lies between 0.009 and 0.016. Across all the regression results, ODA has a statistically significant elasticity with respect to agriculture value added. The response of agricultural value added to ODA for agricultural development per worker, currently and lagged by one year, ranges from -0.02 to +0.02.

Table 3: **Effect of official development assistance on agriculture value added per worker: the leading recipient sectors**

Dependent variable: agriculture value added per worker								
ln(agriculture value-added per worker (-1))	0.940*** (0.000)	0.875*** (0.000)	1.033*** (0.000)	0.985*** (0.000)	0.984*** (0.000)	0.940*** (0.000)	0.977*** (0.000)	0.999*** (0.000)
ln(Total oda for agriculture per worker)	0.026*** (0.000)	0.021** (0.032)						
ln(oda for rural development per capita)		0.011** (0.017)	-0.009 (0.284)	-0.003 (0.543)	0.015*** (0.009)	0.016*** (0.005)	0.006*** (0.000)	0.008* (0.056)
ln(oda for agricultural development per worker)			-0.024*** (0.002)	-0.010 (0.255)	0.002 (0.718)	0.015*** (0.006)	0.008** (0.032)	0.010* (0.054)
ln(oda agricultural development per worker (-1))				0.003 (0.580)		0.006* (0.068)		
ln(oda agricultural policy and management per worker)			0.016*** (0.005)	0.018*** (0.006)	0.004* (0.090)	0.002 (0.250)	0.009* (0.065)	0.003 (0.202)
ln(oda food crops production per worker)					-0.005*** (0.007)	-0.006*** (0.004)		
ln(oda industrial crops or export per worker)					0.004*** (0.002)	0.004*** (0.001)		
ln(oda agricultural cooperatives per worker)							0.011*** (0.001)	-0.0004 (0.846)
ln(oda agricultural inputs per worker)							-0.002** (0.0.34)	-0.004** (0.017)
ln(oda agricultural inputs per worker(-1))								0.002* (0.054)
Constant	0.338 (0.184)	0.786*** (0.000)	-0.200 (0.180)	0.108 (0.381)	0.123 (0.226)	0.386*** (0.003)	0.164*** (0.001)	-0.0007 (0.986)
Observations	445	423	401	373	220	213	254	217
Countries	36	36	36	36	30	30	30	30
Instruments	17	19	21	23	25	26	27	29
AR(1) [p-value]	0.000	0.000	0.001	0.001	0.016	0.019	0.029	0.050
AR(2) [p-value]	0.320	0.289	0.183	0.257	0.269	0.240	0.321	0.379
Sargan-test [p-value]	0.645	0.612	0.632	0.626	0.201	0.257	0.403	0.584
Hansen-test [p-value]	0.407	0.576	0.659	0.461	0.523	0.673	0.305	0.623

***significant at 1 percent; ** significant at 5 percent; * significant at 10 percent; p-values are in parenthesis; ln(agvapw)≡ln(agriculture value-added per worker); ln(totalodagpw)≡ln(total official development assistance for agriculture per worker);ln(odaruraldevpc) ≡ln(official development assistance for rural development per capita; ln(odainputpw) ≡ln(official development assistance for agricultural inputs per worker; ln(odadmgtpw) ≡ln(official development assistance for agricultural policy and administrative management per worker; ; ln(odacooppw) ≡ln(official development assistance for cooperatives per worker; ln(*variable*) ≡ natural logarithm of a variable.

A number of important results stand out from Table 3: First, ODA agricultural policy and administrative management have a positive effect on agricultural productivity. The implication of this finding is that aid policy and management influence aid effectiveness (Whitfield and Maipose, 2008). The second interesting finding is that agricultural productivity responds negatively to ODA for food crop production and positively to ODA for industrial (export) crop production, a substitution effect that favors the latter. This is a little complicated as ODA can both be a limiting and an enabling factor. ODA taxes (limits) food crop production and subsidizes (enables) industrial crop production. The efficiency cost of such substitution effects and the resource re-allocation it engenders are likely huge. However, these results are consistent with existing literature (Eicher, 2003; Carlsson, Somolekae, and van de Walle, 1997), and can be demonstrated (see Islam, 2011 for practical examples). Theoretically, if aid negatively affects the price of domestically produced food crops by αP_d, then it essentially increases the marginal cost of food crop production (MC_d), and thereby reducing profit from food crop production (π_d), such that

$$P_d = MC_d + \alpha P_d + \pi_d = (1-\alpha)P_d = MC_d + \pi_d \Rightarrow P_d = \frac{(MC_d + \pi_d)}{1-\alpha}, 0 < \alpha < 1,$$

which suggests that as α increases, P_d increases and the quantity demanded of domestically produced food crops declines, compelling consumers to shift demand to industrial (export) crops. A higher demand for export crop motivated industrial crop production but discouraged the domestic supply of food crops. In other words, people ultimately consume what they do not produce, and also produce very little or nothing to export – the roots of food aid dependency. Even though policy and management favor agricultural productivity, since the effects of aid for industrial agricultural production are both positive and larger than those of aid for food crop production, one can infer competition for aid between the two sectors. Third, the inclusion of aid

for cooperatives and agricultural development is clarifying, but the coefficients of these variables are unstable and switch arithmetic signs. It is also interesting to find that when we control for ODA for agricultural cooperatives, ODA for agricultural development also attains a consistently positive effect without a lag. Hence, it is reasonable to assume these variables affect agricultural value added positively, at least on the internal margins. Cooperatives can play roles of supply, marketing, and processing (add-value) to boost profitability. They provide and an institutional arrangement through which agricultural modernization can be achieved by pooling resources, information dissemination, higher bargaining power, and access to credit, all of which reduce transaction costs. This implies that institutional settings surrounding aid policy and management, as well as aid application (use) are critical for agricultural productivity. Fourth, contemporaneous ODA for agricultural inputs constrain agricultural productivity, but the constraint is released within a year. It appears that this type of ODA responds to current year poor yields. Better planning and education would avoid this lag by keeping records of when inputs such as fertilizers ought to be renewed.

Table 4(a): **Effect of official development assistance and institutions on agriculture value added per worker**

Dependent variable: agriculture value added per worker						
	Baseline		Below median value of government effectiveness (< -0.73)		Above median value of government effectiveness (> -0.73)	
ln(agriculture value-added per worker (-1))	0.846*** (0.000)	0.870*** (0.000)	0.961*** (0.000)	1.043*** (0.000)	0.843*** (0.000)	0.852*** (0.000)
ln(total oda for agriculture per worker)	0.033*** (0.000)	0.009 (0.220)	0.030*** (0.000)	0.011 (0.549)	0.045*** (0.000)	0.054*** (0.000)
ln(oda for rural development per capita)	0.006 (0.181)	0.006 (0.147)	0.002 (0.574)	-0.015*** (0.000)	0.008** (0.022)	0.007*** (0.008)
Government effectiveness	0.091*** (0.005)	0.109*** (0.000)	0.045 (0.107)	-0.004 (0.919)	0.185*** (0.000)	0.142*** (0.002)
ln(total oda for agriculture per worker)*Government effectiveness		-0.022** (0.018)		-0.010 (0.518)		0.036*** (0.000)
Constant	1.006*** (0.000)	0.886*** (0.000)	0.250 (0.109)	-0.334*** (0.005)	1.041*** (0.000)	0.919*** (0.000)
Observations	423	423	177	177	214	214
Countries	36	36	25	25	24	24
Instruments	21	23	21	23	21	23
AR(1) [p-value]	0.000	0.000	0.076	0.084	0.006	0.005
AR(2) [p-value]	0.267	0.286	0.528	0.338	0.700	0.678
Sargan-test [p-value]	0.507	0.520	0.373	0.680	0.412	0.566
Hansen-test [p-value]	0.344	0.471	0.322	0.651	0.671	0.815

Table 4 (b):Effect of official development assistance and institutions on agriculture value added per worker

Dependent variable: agriculture value added per worker						
ln(agriculture value-added per worker (-1))	1.002*** (0.000)	1.010*** (0.000)	0.969*** (0.000)	0.963*** (0.000)	0.938*** (0.000)	0.990*** (0.000)
ln(oda for rural development per capita)	-0.006 (0.507)	0.009 (0.263)	-0.002 (0.745)	0.014*** (0.010)	0.037** (0.033)	-0.006 (0.606
ln(oda for agricultural development per worker)	0.001 (0.815)	0.009 (0.182)	0.022*** (0.000)	0.008 (0.104)	0.006 (0.578)	0.015*** (0.001)
ln(oda agricultural policy and management per worker)	0.012 (0.134)	0.010* (0.083)	0.007 (0.146)	0.003 (0.173)	0.008* (0.056)	0.005 (0.504)
ln(oda food crops production per worker)	-0.020*** (0.005)	-0.028*** (0.000)	-0.015*** (0.003)	-0.004** (0.021)	-0.003 (0.756)	-0.011** (0.011)
ln(oda industrial crops or export per worker)	0.007*** (0.001)	0.005** (0.037)	0.006*** (0.000)	0.005*** (0.000)	0.005 (0.128)	-0.001 (0.750)
Government effectiveness	0.075*** (0.003)					
Control of corruption		0.055** (0.016)				
Property rights			0.083*** (0.002)			
Business freedom				0.047* (0.074)		
Trade freedom					0.137** (0.038)	
Tax burden						-0.184* (0.056)
Constant	0.027 (0.808)	-0.050 (0.645)	-0.094 (0.267)	0.071 (0.661)	-0.157 (0.636)	0.832** (0.834)
Observations	220	220	212	213	212	212
Countries	30	30	29	30	29	29
Instruments	27	27	27	27	27	27
AR(1) [p-value]	0.008	0.005	0.013	0.019	0.018	0.016
AR(2) [p-value]	0.279	0.364	0.211	0.213	0.291	0.267
Sargan-test [p-value]	0.345	0.287	0.447	0.272	0.194	0.172
Hansen-test [p-value]	0.693	0.311	0.401	0.468	0.443	0.319

Tables 4(a) and 4(b) present our estimates of the role institutions play in agricultural productivity. Table 4(a) examines whether government effectiveness can enhance the impacts of ODA on agricultural labor productivity in SSA. We control for three levels of government effectiveness as a measure of the quality of institutions (governance): baseline, below median value of government effectiveness (< -0.73), and above median value (>-0.73). In the baseline scenario, a percentage rise in government effectiveness strengthens the impact of ODA on agricultural valued-added per worker by up to 18.5%, and by 10.2% in the above, and baseline scenarios, respectively. However, when government effectiveness is below the median value of effectiveness, it has no significant effect. The findings are consistent with Brautigam and Knack (2015), Alabi (2014), Brautigam (2013; cf. Brookings Institution, 2013), and Eicher (2003), to mention only few. The baseline equation with an interaction between government and total ODA gives inconclusive results. Even so, since government effectiveness is positive, for the interaction term to have a negative effect it would be the case that aid has a negative effect. Conversely, when government effectiveness is above the median value, the interactive term has a positive coefficient, implying that ODA is more effective in countries where government effectiveness is high. In Table 4(b) we use the breakdowns of ODA, government effectiveness, control of corruption, and various components of economic freedom. The components of economic freedom included are: property rights, business freedom, trade freedom, and tax burden, all obtained from The Heritage Foundation. Again, we find suggestive evidence that better institutions and economic freedom contribute towards agriculture development, while the tax burden is an obstacle. A one percent improvement in property rights, business freedom, and trade freedom increases agricultural productivity by 8>3%, 4.7%, and 13.7%, respectively.

These findings concur with conventional wisdom. According to Schultz (1964), for instance, many farmers remain poor not because they are backward and traditional but because their governments do not provide them enough technical and economic possibilities. Schultz emphasized the importance of making available to farmers inputs and extension services through which information regarding new technologies can be disseminated. He also argued that peasants in poor countries are rational decision makers (responding to incentives) who maximize the returns from their resources in accordance with the institutional policies. For instance, the unwillingness to innovate observed in developing economies was rational because governments of these countries often set low crop prices and taxed them heavily. Since a tax is cost, it reduced farmers' incentive to produce by lowering profits. Hence, by extension one may say that the lack of marketing opportunities and infrastructures makes farmers choose to produce small quantities.

Aware of the potential endogeneity between ODA, agricultural productivity, and unobservable factors affecting the effectiveness of ODA, we explore the allocation process. If ODA is more driven by need, it might flow more to low productivity areas even when effectiveness might be low. Under this scenario the effectiveness of ODA might be veiled. On the other hand, if donors want to boost agricultural productivity, then ODA would flow mostly to countries where it is likely to be more effective regardless of the level of the relative need for ODA. Hence, our next question is: What determines the allocation of ODA? Is ODA flowing to countries where it is more likely to achieve success, or where the need is greatest? Is ODA flowing to countries where agriculture value-added is already increasing due to some other third factor? Panel (a) of Table 5 addresses the question of ODA allocation, while the GMM

techniques addressed the potential endogeneity issue. The two variables of interest are the rate of increase in agricultural value-added per worker and government institutions.

Table 5 (a) and (b): Determinants of allocation of aid for agriculture and structural transformation

(a) determinants of allocation of aid for agriculture: the dependent variable is future total aid for agriculture $ln(totalodagpw)_{t+1}$					(b) structural transformation: the dependent variable is agriculture value added percent of GDP	
ln(future total aid for agriculture per worker) current year	0.704*** (0.000)	0.792*** (0.000)	0.696*** (0.000)	0.802*** (0.000)	ln(agriculture value added percent of GDP(-1))	0.963*** (0.000)
ln(agvapw) *minus* ln(agvapw(-1)) = *volatility or rate of increase in agvapw*	4.551** (0.024)	9.011*** (0.003)	5.643*** (0.010)	8.033*** (0.002)	ln(GDP per capita)	-0.118* (0.077)
Government effectiveness	0.397** (0.043)	0.290 (0.150)			Ln(urban population percent of total population)	0.216** (0.027)
Volatility* Government effectiveness		5.626*** (0.003)			ln(total ODA for agriculture per worker)	-0.018* (0.071)
Control of corruption			0.519* (0.071)	0.378 (0.108)		
Volatility* Control of corruption				5.858** (0.024)		
Constant	1.012*** (0.000)	0.698*** (0.000)	1.033*** (0.000)	0.698*** (0.001)	Constant	0.183 (0.674)
Observations	409	409	409	409	Observations	433
Countries	36	36	36	36	Countries	35
Instruments	18	20	18	20	Instruments	21
AR(1) [p-value]	0.001	0.000	0.001	0.000	AR(1) [p-value]	0.001
AR(2) [p-value]	0.713	0.901	0.660	0.963	AR(2) [p-value]	0.508
Sargan-test [p-value]	0.301	0.519	0.501	0.604	Sargan-test [p-value]	0.550
Hansen-test [p-value]	0.334	0.449	0.305	0.478	Hansen-test [p-value]	0.424

First, the results show that future ODA for agriculture will go where agricultural productivity is increasing, and that the higher the productivity increase the more ODA. Assuming a standard production function for agriculture with diminishing marginal returns, the marginal product of ODA is higher at lower levels of output than at higher levels. Consequently, ODA for agriculture is likely to have a bigger effect in countries where agriculture value-added is low, that is, where the need for ODA is also highest. Second, there is suggestive evidence that ODA for agriculture goes where government institutions are increasingly effective. Third, we find that countries where institutions are increasingly effective, also increase the extent to which the rate of increase in productivity attracts more aid. Need is not estranged from effectiveness. However, in and of themselves, institutions are a weak determinant of how much agricultural ODA a country will receive. Therefore, need and effectiveness, together, are the strongest determinants of ODA allocation. ODA allocation to areas in need has a strong marginal impact on agricultural value added per worker that falls between 4.55 and 9.01 percentage points, and capable of increasing by approximately 6 percentage points under better government effectiveness, a morally heart-warming fact. Unfortunately, in SSA poor people live in rural areas, and it is precisely in these areas where ODA has negative substitution effects on agricultural labor productivity between food crop production and industry crop production.The history of total ODA for agriculture per worker, and of agricultural labor productivity is important for ODA allocation (see Islam, 2011). This result lines up well with previous studies. For instance, in a study of German trade with and aid to Namibia, Amavilah (1998) found that colonial associations favor foreign aid even though the effects of aid on labor productivity are lower than those of both trade and domestic capitalformation. The unexplained effects (constant

terms) are significant but much smaller, implying that the volatility of agricultural output (need) and government institutions are the key determinants of how much ODA a country receives.

We end this part of result discussion upholding that ODA does indeed affect agricultural productivity. Question: Is such an effect structurally transformative? Panel B of Table 5 gives an illustrative example, albeit a short one. In this example, structural transformation is assessed using agriculture value added as a percent of GDP, that is, the relative importance of agriculture to the economy. We examine what happens to agriculture value-added percent of GDP as ODA for agriculture per worker increases. First, we find that agriculture value-added percent of GDP is inversely related to increases in ODA for agriculture per worker. This is a natural result because structural transformation in developing countries often begins with an increase in agricultural output per worker creating a surplus in the rural economy, which is progressively transferred into the nonagricultural sectors. We have already established that ODA increases agricultural value-added per worker. Second, as economies grow (as GDP per capita increases) agriculture becomes less dominant, and its share of both GDP and employment declines (Islam, 2011). Hence, GDP per capita is inversely associated with agriculture value-added percent of GDP. According to Engel's law, the proportion of income spent on food declines as income rises. This implies that income grows faster than demand for food resulting into a decline in agriculture as a share of national income. This result provides further suggestive evidence that structural transformation is taking place in SSA. The above two effects go hand in hand, implying that to be sustainably effective, ODA requires economic growth. Even if one were to argue that under some conditions economic growth might require assistance to ignite it, as it was the case for the Marshall Plan for Europe after WWII.

In the structural transformation regression in Table 5(b), we also find that urban population growth positively affects agriculture value added as a percent of GDP. In the framework of structural transformation, this is an unnatural result. Since urbanization in the SSA is mostly driven by rural-urban migration, the loss of youthful farm labor could have had a negative effect on agricultural output – meaning that the rate of rural-urban migration is slower than the rate of decline in agricultural output. Second, as the urban sector grows one would have expected the share of agriculture to GDP to decline given that nonagricultural urban incomes are generally expected to be higher than the farm (rural) incomes. However, urbanization can have a positive income effect as it increases the market for agricultural output. It appears that the positive market-income effect outweighs the negative labor-resource (substitution) effect. This is a confounding outcome, because it means aid adds to the market income of urban dwellers but subtracts from the already meager market income of rural people. Consequently the former's money income increases; the latter's money income decreases. Third, according to the African Development Report (2015) the pattern of structural transformation in Africa is different from the classical pattern of transitioning from agriculture, manufacturing, to knowledge based services. In Africa, labor that is moving out of agriculture and rural areas is not primarily going into manufacturing industries and high-skill services, but is mostly absorbed into low-skill services and informal urban activities whose level of productivity is low than in agricultural sector. Hence, other things constant, in the SSA, for our sample and time period, in and of itself urbanization is not significantly increasing the nonagricultural incomes relative to the farm-rural incomes. Fourth, if there is an inverse relationship between agriculture value added percent of GDP and GDP per capita, and a positive relationship between agriculture value added percent of GDP and urban population growth, in the event that the growth rate of urban population is higher

than the growth rate of the economy, the inevitable outcome is negative transformation in rural areas (implied by the substitution effects we described above) and by the struggle in urban areas (indicated by life in shanty towns).

5. Conclusion and future research directions

This paper has assessed whether the official development assistance (ODA) for agriculture and rural development are helping to boost agricultural productivity in 36 sub-Saharan African countries for the period 2002-2015. The empirical evidence is based on a system two-step Generalized Method of Moments. It finds that across all regressions presented in Tables 3-5, summary statistics are reasonable; the regressions are well-estimated, and the estimates are as efficient as possible. It is understandable that some estimates may be biased, especially in light of the small sample and a short study period. This weakness represents one future research opportunity. For now, and we expand on this in the appropriate section of the paper, the results show that ODA is neither an automatic panacea nor an immutable curse (constraint). Its effects vary across areas receiving it, and those likely differ within and across individual countries in SSA. Many factors determine the allocation of ODA; in this paper we identified "need and effectiveness" as the joint determinant of allocation. Areas that need ODA do indeed get aid, but the allocations are higher if the anticipated effectiveness is high. Unfortunately, the substitution effects discussed above make ODA for rural agricultural development damaging to the very same people it was supposed to help, and most people in SSA live in rural areas and depend primarily on agriculture for their livelihoods. Here, too, we find ourselves in agreement with Islam's (2011) assertion that "the task of measuring, analyzing, and evaluating aid to agriculture in all is components, principles and implications remains a challenging task for researchers,

policy analysts and policy makers" (p. 41). Moreover, other determinants of agricultural productivity such as agricultural research and effects of climate change to productivity are fruitful areas for future research.

While success, like "beauty [that] is in the eyes of the beholder," is subjective in that one cannot tell a starving man that his receiving a free meal is failure, the movement to urban areas gives a false impression of structural transformation of agriculture in SSA. The feedback effects in terms of negative association from ODA for food crop production and increased "squalor" urbanization, and both seriously question the effects of ODA on economic growth and development in SSA – a critical comment on Lewis's model of "development with unlimited supply of labor" which we do not pursue in this paper. We tentatively argue that not all ODA is an effective mechanism for structural transformation of agriculture in SSA. In fact, structural transformation would require sustained and sustainable growth as well as effective institutions for policy, management, and use of ODA.

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