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The Effectiveness of Development Aid for Agriculture in Sub-Saharan Africa

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Abstract

Purpose: Agriculture is the major source of livelihood for the majority population in Sub-Saharan Africa but its productivity is not only low it has started showing signs of decline since 2012. The paper seeks to find out whether official development assistance for agriculture is effective.

Design/Methodology/Approach: The data for development assistance for agriculture are broken down into the major agricultural sectors in receiving countries. The empirical evidence is based on the two-step system Generalized Method of Moments to assess the degree of responsiveness of agricultural productivity to development assistance.

Findings: 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. The structural economic transformation associated with agricultural development assistance is also found to be weak.

Practical Implications: Allocation of development assistance for agriculture is primarily determined by need, although expected effectiveness also increases the assistance receipts. Agricultural assistance policies could focus more on building productive capacity to reduce the need while boosting effectiveness.

Originality: Breaking down data into agricultural recipient sectors, and controlling for the potential spurious correlation under the assumption that more development assistance could be allocated where agricultural productivity is already increasing due to some other factors.

JEL Classification: F35; F50; Q10; O10; O55

Keywords: Official Development Assistance; Agriculture; Sub-Saharan 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 (Dao, 2009). 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 non-agricultural sectors, particularly among the households below the poverty line. They find that both consumption and employment increase if households use fertilizers to raise 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 a typical SSA 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 further 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 recovered. 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).

<Figure 1>

Some of the targets of the United Nations Sustainable Development Goals (SDGs) after 2015 are: ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture. Due the underproduction of food in Africa relative to the population, the AfDB Feed Africa Strategy predicts food imports by Africa 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. This raises several concerns one of which is pointed out by Van Weezel (2016), who finds that food price increases are associated with an increase in violence intensity of 1.3 incidents, an effect predominantly driven by imports of low-value-added primary products. To achieve the SDGs goals there is 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, they still pulled many Asian countries out of abject poverty (Gonzales, Kasryno, Perez, Rosegrant, 1993; Dethier and Effenberger, 2012).

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. An index of 1.0 (or higher) suggests 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>

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. This focus raises

serious questions, because natural resources like oil booms tend to be associated with both Dutch diseases (Benjamin, Devarajan, and Weimer, 1989; Davis, 1995; Torvik, 2001, Matsuyam, 1992; Fardmanesh, 1991; Corden 1984) and competitive rent-seeking behavior (Krueger, 1974; Krueger, Schiff, and Valdes, 1988).

In the light of the goals of the African Union, the ongoing 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. Specifically, it asks and seeks to answer three closely related questions: Question 1: Looking at the leading recipient sectors, is official development assistance for agriculture helping to increase value added per work (productivity in SSA)? Question 2: Do better institutions enable official development assistance for agriculture to be more effective in SSA? Question 3: What are the key determinants of aid allocation, and do they engender any structural transformation of the region? We start with these questions, because earlier studies have examined with mixed results the role of foreign aid in general or aid to agriculture in economic growth and poverty reduction (Kaya, Kaya and Gunter, 2012, 2013; Mavrotas, 2003, 2003; Clemens et al., 2012). Indeed, the link between foreign aid and economic growth a recursive debate (Easterly, 2006; Moyo, 2009; Deaton, 2013). This paper contributes to the debate in a number of ways, including the following four. 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 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 assessment is important because majority of previous studies on the effectiveness of development assistance on economic growth have used economic growth (i.e. per capita GDP or income for the most part) as the dependent variable (Asiedu, 2014; Wamboye et al., 2013 ; Quartey and Afful-Mensah, 2014 ;

Kargboand Sen, 2014; Gyimah-Brempongand Racine, 2014; Kumi et al., 2017). The paper departs from this stream of literature by using the level of agricultural productivity for two reasons. Previous research has conceived a national economy as consisting of three sectors: Primary, secondary (industrial), and tertiary (services). We think of the primary sector as made up of the agriculture, forestry, fishing, and mining parts. From here we first examine the effects of ODA on the level of agricultural productivity, and secondly on whether such productivity level is transformative. Transforming agriculture, to the extent most Africans depend on agriculture for their livelihoods, has important implications for national development. We use productivity level instead of productivity growth because growth in subject changing market conditions and business cycles. Productivity level is an indicator of the standard of living and efficiency. Growth can happen, but it is unsustainable in the long-run, without efficiency. 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 underpinning of Chenney-Strout model maintains that

developing countries are confronted with the lack of savings and "export earnings" may not be appropriate for enhancing investment. Despite the apparent shortcomings underlying its postulations, the model provided the basis for empirical papers on development assistance in the past decades (Easterly, 1999; Masudand 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 and Nwachukwu (2018). In response to the growing poverty levels in Africa, Kuada (2015) has proposed a new development paradigm based on shifting from "strong economics" of structural adjustments policies to "soft economics" of 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 and Söderbom, 2015; Page and 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 (Nukpeza and Blankson, 2017); multinationals in Africa's food retail businesses (Nandonde and Kuada, 2017); transmission of international food prices (or imported inflation)to African markets(Furceri et al. 2016; van Weezel, S., 2016; 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 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[2]. 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

[2]The Roodman xtabond2 which is used in the analysis is designed to be used without non-overlapping intervals (in terms of data averages) because instruments are collapsed to reduce overidentification. This narrative is consistent with recent literature (Tchamyou, 2018; Tchamyou and Asongu, 2017).

Organization for Economic Co-operation and Development (OECD) Creditor Reporting System (CRS) database. 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>

Again, figures 1 and 2 portray the key variables. 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>

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 in completions 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 rising agricultural productivity, which is not always the case in SSA. Therefore, we use the two-step system Generalized Method of Moments[3] (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998; Roodman, 2009ab) to estimate the association between ODA for agriculture and agriculture value-added per worker in equation (1).

[3]We estimated the system GMM following the recommendations of Arellano and Bond that it is designed for a few time periods and many individual units, where the dependent variables depends on its past realizations and the independent variables are not strictly exogenous, which is true for most macroeconomic variables. We estimated a Dynamic Panel data Two-step system GMM instead of the difference GMM because of small sample bias issues associated with difference GMM estimator. Alonso-Borrego and Arellano (1999), and Blundell and Bond (1998) point out that when explanatory variables are persistent over time, lagged levels of these variables make weak instruments for regressions in differences, and instrument weakness in turn influences the asymptotic and the small-sample performance of the difference estimator. We perform diagnostic tests which accompany the xtabond2 routine: the *gmm-style* and *iv-style* instruments; AR tests for autocorrelation of the residuals being careful that the differenced residuals do not exhibit significant AR(2); robust, two-step, small; Sargan and Hansen tests of overidentifying restrictions. The lags were limited to not more than lag(3 3).The rule of thumb for avoiding instrument proliferation is respected: in every specification the instruments are less than the corresponding number of countries. This clarification has been included in the footnote of attendant tables.

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

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

$$\varepsilon_{it}$$

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

where *agvapw* stands for the agriculture value-added per worker, $odagri$ is the total ODA for agriculture; $odaruraldev$ is the ODA for rural development; δ_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.

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

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

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

$$\varepsilon_{it}. \quad (2)$$

We control for government effectiveness both directly and indirectly. 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[4]. Two, about the determinants of ODA allocation for agriculture.

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

[4]One period lag is used to complement contemporaneous ODA in the estimations in order to increase some bite on endogeneity (Clemens et al., 2012; Asongu and Nwachukwu, 2017).

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 similar but of opposite sign to that obtained by Alabi (2014) 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>

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 practically (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

$$P_d = MC_d + \alpha P_d + \pi_d = (1-\alpha)P_d = MC_d + \pi_d \Rightarrow P_d = \frac{(MC_d + \pi_d)}{1-\alpha}, 0 < \alpha < 1, \quad (4)$$

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, and 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 ODA for agricultural cooperatives, ODA for agricultural development also attains a consistently positive effect without a lag. Hence, it is reasonable to assume that 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 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. When modeling China's agriculture support policy effects, He (2016) finds that input subsidy policy has more effects on production while area payment policy has more effects on farmer's income.

<Table 4 (a)>

<Table 4 (b)>

Tables 4(a) and 4(b) present 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. Clearly ODA flows through government. Just as clearly, other institutional factors and forces are important as well. 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 agricultural 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. Thus, it is trade, rather than aid, that drives agricultural productivity.

These findings confirm 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 dealt with the issues of potential endogeneity. The two variables of interest are the rate of increase in agricultural value-added per worker and government institutions.

< Table 5 (a) and (b)>

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. 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 industrial (export) 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: one, Moore and Stanford (2010) find that the two top determinants of food aid dependence were cereal production and the frequency of droughts. Two, 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 capital formation. The unexplained effects (constant terms) are significant but small, 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. In the 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 (Baffes and Etienne, 2016). 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. Within 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, where money income is the income required to meet basic needs and is the sum of market income plus government transfers including aid.

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 absorbed 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. Historically governments in SSA, as in other developing areas, have closed the gaps by enlarging the tertiary sectors, creating huge deficits which they then financed with debt, aid, or both. 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. Baffes and Etienne (2016) show that income influences real food prices mainly through the manufacturing price channel; a result which is consistent with both Engel's law and Kindleberger's thesis. 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 hardship 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, 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. Technically speaking for the urban household income effects dominate substitution effect; for

rural households substitution effects are greater than income effects, except that there are no substitute. This is simply an indirect characterization of poverty. 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 to refuse a free meal, the movement to urban areas gives a false impression of structural transformation of agriculture in SSA. The feedback effects in terms of the 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 conclude 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.

While the paper only considers ODA for agriculture and rural development, ODA to other sectors can have an indirect effect on agricultural productivity. For example, ODA to the infrastructure and the industrial sector can facilitate pulling workers from the agricultural sector to the industrial sector. Moreover, with limited supply of land, fewer workers on the land can by itself improve agricultural productivity. Although we do not control for the indirect of non-agricultural ODA on agricultural productivity we are aware of such effects. First, ODA to the

industrial sector and infrastructure facilitates worker migration to the industrial sector, but the improvement in the agricultural sector is more than offset by the negative effect of jobless urbanization. This is one of the reasons we point to the larger substitution than income effects of ODA. Second, some of the effects of non-agricultural ODA are likely reflected in the constant term and in rural development ODA. Future studies should focus on the extent to which different components of ODA can be correlated and how the established findings withstand empirical scrutiny when ODA from other sectors are added to the regressions.

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

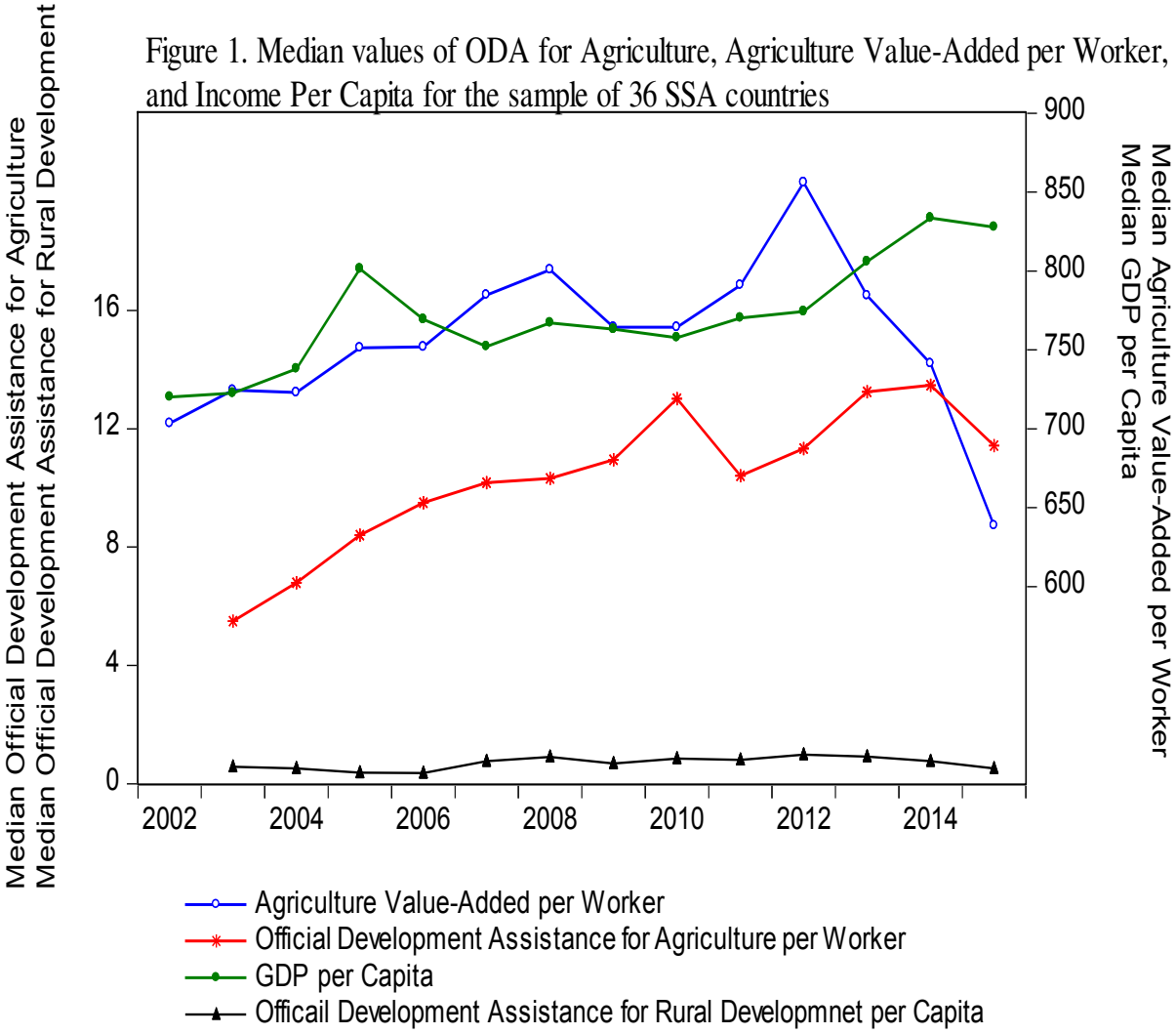

Figure 2: Median values of select areas of official development assistance for agriculture (36 SSA countries)

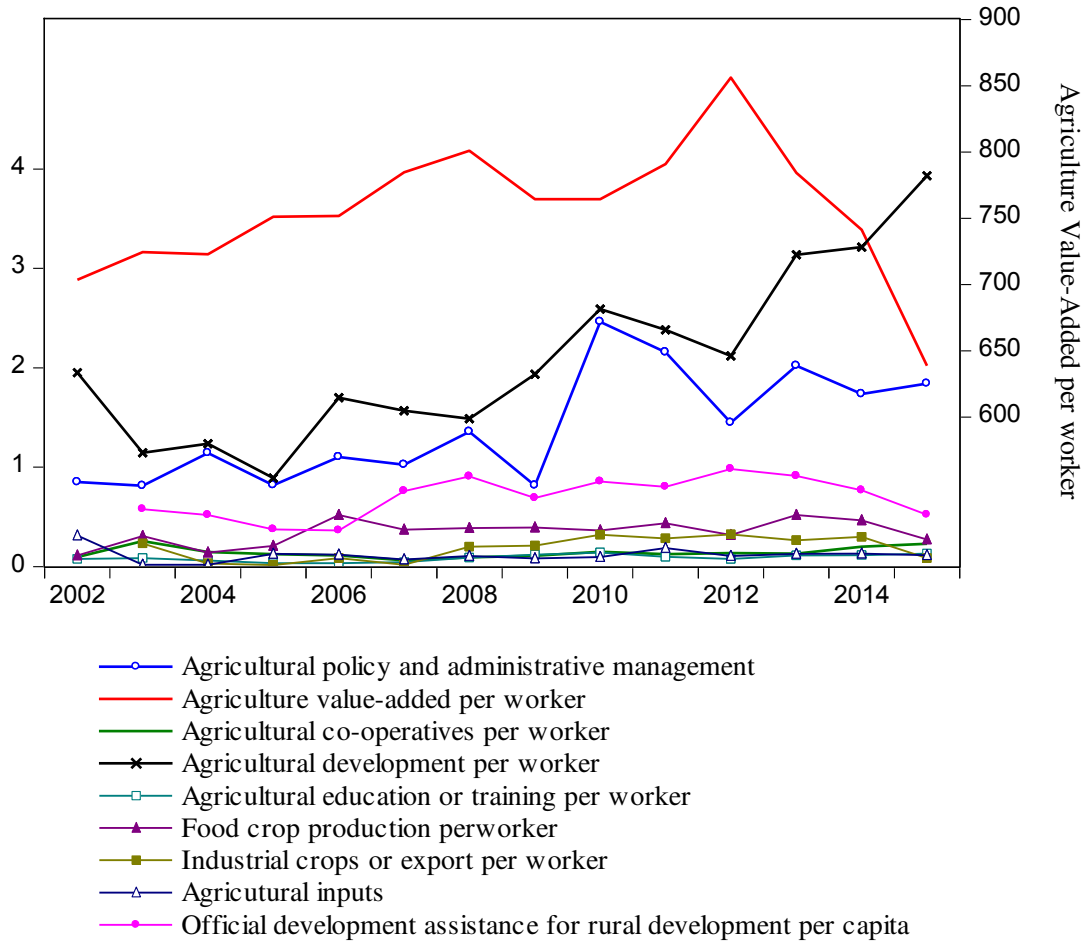

Table 1: A snapshot of Public Expenditure in Agriculture in Sub-Saharan Africa (2001-2015)

	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.

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

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** (0.034)	-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(oda)≡ln(total official development assistance for agriculture per worker); ln(*variable*) ≡ natural logarithm of a variable. The rule of thumb for avoiding instrument proliferation is respected because in every specification, the instruments are less than the corresponding number of countries.

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

***significant at 1 percent; ** significant at 5 percent; * significant at 10 percent; p-values are in parenthesis. The rule of thumb for avoiding instrument proliferation is respected because in every specification, the instruments are less than the corresponding number of countries.

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

***significant at 1 percent; ** significant at 5 percent; * significant at 10 percent; p-values are in parenthesis. The rule of thumb for avoiding instrument proliferation is respected because in every specification, the instruments are less than the corresponding number of countries.

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

***significant at 1 percent; ** significant at 5 percent; * significant at 10 percent; p-values are in parenthesis. The rule of thumb for avoiding instrument proliferation is respected because in every specification, the instruments are less than the corresponding number of countries.