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Impact of Agricultural Foreign Aid on Agricultural Growth in Sub-Saharan Africa

A Dynamic Specification

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Abstract

This study investigates the impact of foreign agricultural aid on agricultural GDP and productivity in Sub-Saharan Africa (SSA). I rely on secondary data regarding foreign agricultural aid, agricultural GDP, and productivity indicators from 47 SSA countries spanning 2002-2010 and employ a Generalized Method of Moments (GMM) framework. The study reveals that the average sectoral aid allocation to agriculture in SSA was 7% during this period, growing from 18 million USD in 2002 to about 47 million USD in 2010. The econometric analysis suggests that foreign agricultural aid has a positive and significant impact on agricultural GDP and agricultural productivity at 10% significance, and that disaster and conflict also have a positive and significant impact on aid receipt at 5% significance. This latter finding implies that foreign agricultural aid responds to disaster and conflicts in this region. The transparency index has a positive but not significant relationship with foreign agricultural aid, agricultural GDP, and agricultural productivity, while the governance index has a positive and significant relationship with agricultural productivity at 10% significance. The study also reveals that bilateral foreign agricultural aid influences agricultural productivity more than multilateral foreign agricultural aid and that multilateral foreign agricultural aid influences agricultural GDP more than bilateral foreign agricultural aid. Scaling up foreign agricultural aid will increase its impact on agricultural productivity and its contribution to the economy of SSA, and sectorial foreign agricultural aid allocation should give priority to factors that will enhance this productivity. For instance, the sectoral allocation to water resources should be increased from the present 8% in order to increase the arable land currently irrigated in the region (4%). Allocation of aid to control plant/post-harvest losses should also be scaled up, as the current level (less than 1%) only reduces crop losses from pests and disease by 50%. Finally, scaling up the funding for research will also be vital to the development of improved seed varieties and the adoption of productivity-enhancing technologies. A sound synergy must be worked out between foreign agricultural aid and domestic agricultural expenditure to support these critical aspects of agriculture in the region.

Résumé

Cette étude examine l'impact de l'aide extérieure dans le domaine agricole sur le PIB et la productivité agricoles en Afrique sub-saharienne (ASS). Nous nous appuyons sur des données concernant l'aide extérieure à l'agriculture, le PIB agricole, et les indicateurs de productivité de 47 pays d'Afrique subsaharienne s'étendant de 2002 à 2010 et employons la méthode des moments généralisés (GMM) comme procédure d'estimation. L'étude révèle que la répartition de l'aide sectorielle moyenne à l'agriculture en Afrique subsaharienne était de 7% au cours de cette période, passant de 18 millions USD en 2002 à environ 47 millions de dollars en 2010. L'analyse économétrique suggère que l'aide extérieure a l'agriculture a un impact positif et significatif sur PIB agricole et la productivité agricole au seuil de significativité de 10%. De même, les catastrophes et les conflits ont également un impact positif et significatif sur le fait de recevoir de l'aide au seuil de 5%. Cette dernière constatation implique que l'aide à l'agriculture répond aux catastrophes et conflits dans cette région. L'indice de transparence a une relation positive mais non significative avec l'aide a l'agriculture, le PIB et de la productivité agricoles, tandis que l'indice de gouvernance a une relation positive et significative avec la productivité agricole au seuil de 10%. L'étude révèle également que l'aide bilatérale influe sur la productivité agricole plus que l'aide multilatérale. En revanche l'aide multilatérale influence le PIB agricole plus que l'aide bilatérale. Accroitre l'aide extérieure dans le domaine agricole augmentera son impact sur la productivité agricole et sa contribution à l'économie de l'Afrique subsaharienne, et la répartition sectorielle de l'aide devrait donner la priorité aux facteurs qui permettront d'améliorer cette productivité. Par exemple, l'allocation sectorielle des ressources en eau doit être augmentée par rapport à la situation présente (8%) afin d'augmenter les terres arables actuellement irriguées dans la région (4%). La répartition de l'aide pour le contrôle des pertes post-récolte devrait également être accrue, étant donne que le niveau actuel (moins de 1%) ne permet de réduire les pertes dues aux parasites et autres maladies de seulement 50%. Enfin, l'élargissement du financement de la recherche sera également vital pour le développement de variétés améliorées et l'adoption de technologies qui améliorent la productivité. Une

bonne synergie doit être trouvée entre l'aide extérieure à l'agriculture et les dépenses agricoles nationales afin de venir à l'appui de ces aspects cruciaux de l'agriculture dans la région.

1 Introduction

In recent years, there has been much discussion about the causes of low agricultural production in Sub-Saharan Africa (SSA). While many factors have been implicated, the decline in agricultural investment is thought to be a major contributing factor, depressing agricultural growth and performance (Islam, 2011). Two components of agricultural investment are of paramount importance. The first is foreign agricultural aid[1], and the second is public domestic expenditures on agriculture. Kalibata (2010) is of the opinion that foreign aid can provide the necessary solutions to the needs of Africa's farmers: need improved inputs, including improved seeds and soils, roads to connect them to markets, agribusiness credit and private sector investments to spur growth, facilities to reduce their estimated 40-60% post-harvest losses, and training and technology to cope with climate change. She suggests that all these factors are important in boosting agricultural productivity, which can accelerate economic growth and raise incomes for communities, countries, and the continent as a whole. She also points out that agricultural growth in Africa depends on a combination of locally driven solutions *and* reliable donor support. Neither ingredient is sufficient on its own.

African leaders have begun to mobilize local resources for agricultural growth in order to reverse the trend of poor government spending on agriculture[2]. This effort involves a powerful initiative to support smallholder farmers using the Comprehensive Africa Agriculture Development Programme (CAADP). Through CAADP, African nations have pledged to devote 10% of their national budgets to agriculture. Between 2007 and 2009, Rwanda increased its investment in agriculture by 30%; in Sierra Leone, agricultural spending has gone from 1.6% of the budget to 9.9% in 2010[3].

To tackle the problem of low development assistance, global leaders gathered at L'Aquila in 2009 and pledged $22bn toward food security, helping to reverse three decades of declining donor support for agriculture. The G20 in Pittsburgh called for a multilateral fund to scale up assistance for the agricultural sector. To advance this commitment, the United States, Canada, Spain, South Korea, and the Bill and

[1] Official Development Assistance or aid that is aimed at increasing economic development.

[2] African Heads of States met in Maputo, Mozambique in 2003 and pledged to allocate 10 percent of their budgets to agriculture by 2008(Somma,2008).

[3] According to NewAfrican (2014), although only 20% of SSA countries have met the Maputo's target of 10% investment in Agriculture, but those that did had positive results. For example Ghana spent 9.1% of her budget on Agriculture between 2003 and 2010 and her per capita output increased more than 17 times during the period. Burkina Faso averaged 16.9% of public spending on agriculture from 2003 and 2010; this step had created 235,000 agricultural jobs within the period. Ethiopia also spent 15.2% of her budget on agriculture and the extreme poverty declined by 49% within the same period. The trend in agriculture budget is positive for Nigeria, the share of agriculture in Federal Government's annual budget ranges between 1.3% and 7.4%, it stood at 2% in 2007 and this has consistently fallen below the Maputo Declaration of 10% share of total country budget for agriculture. Nigerian government expenditure on agriculture is equally less than 1% of the total GDP in Nigeria (Alpuerto et al, 2009). All these are indication of the low priority government has placed on agriculture in Nigeria (Iganiga and Unemhilin, 2011). In fact, to improve investment in agriculture in Nigeria Alpuerto et al, (2009) have indicated that expenditure in agriculture must increase by 24% over the current situation.

Melinda Gates Foundation launched the Global Agriculture and Food Security Programme to help the world's poorest farmers[4].

The development of agriculture in every country in the world has required government assistance. While rich countries like the United States and those of Europe can, and do, provide aid to their own farmers, most African countries are poor and are so far behind developed countries in terms of agricultural development that they may not have enough resources to provide the necessary aid by themselves. Thus they are reaching out for development aid to help their people can feed themselves (NEPAD, 2010). According to ECA (2009), development partners must increase assistance to Africa's agricultural sector in order to help broaden and accelerate the continent's recent economic and agricultural growth in order to raise the number of countries that will achieve MDGs.

However, the subject of foreign agricultural aid remains a thorny issue among donors and recipient countries alike. While the recipient countries want more foreign aid to increase their agricultural production, donors focus on the effectiveness of aid-funded projects in order to justify the need for future aid. There is thus a need for empirical investigation into the impact of aid on agriculture, especially using dynamic estimation methods that take into account the stochastic nature of the economic agents involved in foreign aid administration and usage. This study will help recipient countries improve their agricultural growth and productivity and will also be useful to donors in gauging the effectiveness of their funding for African agriculture.

1.1 Research Questions

This study aims to answer the following questions:

1. What are the forms of foreign agricultural aid being implemented in SSA?
2. What are the utilization profiles of foreign agricultural aid in SSA?
3. What is the impact of foreign agricultural aid on agricultural GDP and productivity in SSA?
4. Which type of foreign agricultural aid (bilateral, multilateral, etc.) has the most impact on agricultural productivity and agricultural GDP in SSA?
5. Does foreign agricultural aid respond to issues such as disaster, transparency and corruption, government policy effectiveness, etc.?
6. What measures can improve the effectiveness of foreign agricultural aid to SSA?

2 Effectiveness of Foreign Aid on Economic Growth

There are two sides to the debate on the impact of foreign aid on economic growth. One side argues that aid has a positive effect on economic growth, particularly in countries with sound economic and

[4] Global food price spikes in 2007 and 2008 increased undernourishment by an estimated 6.8% and drove at least 100 million more people into poverty. This led to the launch of the New Global Agriculture and Food Security Program to fight food insecurity through improved agricultural productivity among poor and rural populations (World Bank, 2010).

trade policies, while the other side contends that foreign aid fosters corruption, encourages rent-seeking behavior, and erodes bureaucratic institutions. A renewed interest in cross-country economic growth emerged in the early 1990, but to date, there is no consensus among scholars as to the actual effects of foreign aid on economic growth (Whitaker, 2006).

Several prominent studies have found a causal link between foreign aid and economic growth, perhaps the most well-known being that of Burnside and Dollar (1997). They found that foreign aid enhances economic growth as long as "good" fiscal policies are in place. These policies can include maintaining small budget deficits, controlling inflation, and being open to global trade. Durbarry et. al. (1998) also found a positive association between foreign aid and economic growth and confirmed Burnside and Dollar's findings of the importance of good economic policies. The study also concluded, however, that the degree to which aid impacts GDP depends largely on other factors such as geography. Ali and Isse (2005) further confirmed the findings of Burnside and Dollar, but their study also demonstrated that aid is subject to decreasing marginal returns, indicating a threshold beyond which development assistance can become detrimental to economic growth.

Even before Burnside and Dollar's monumental findings, however, a study by Boone (1995) found that aid-intensive African countries experienced zero per capita economic growth in the 1970s and 1980s, despite an increase in foreign aid (as measured by share of GDP)[5]. Additionally, Knack (2001) found that high levels of foreign aid can erode bureaucratic and institutional quality, trigger corruption, and encourage rent-seeking behavior. The most ardent critics of aid programs, such as Bauer (1971) and Friedman (1958), attack foreign assistance on the grounds that politicians will not allocate aid efficiently when measured against the goals of aid programs. They argue that recipient countries will consume capital inflows because a lack of domestic savings reflects a lack of opportunities. There is also evidence that the effects of foreign aid can be mitigated by other non-economic factors. Situations of state failure, such as ethnic conflict, genocide, and revolution, can also all potentially influence the extent to which aid impacts growth.

Whitaker (2006) indicates that massive expenditures on foreign aid programs by developed nations and international institutions, in combination with the perceived lack of results from these disbursements, raise important questions as to the actual effectiveness of monetary assistance to less developed countries (LDCs). In his analysis, he focused on 119 low- and medium-development countries and measured the impact that foreign aid has on their growth rates of gross domestic product, using dummy variables for geography and conflict in a geometric lag model. The results indicate that foreign aid donations do have a positive impact on the economic growth of the recipient nation. The effect is extremely modest, however, and other factors such as armed conflict and geography can easily mitigate this impact, in some cases to the extent that foreign aid becomes detrimental to economic growth.

[5] Boone (1995) concluded that aid does not significantly increase investment and growth, nor does it benefit the poor; however, it does increase the size of government. He also found that aid's impact does not vary according to whether recipient governments are liberal democratic or highly repressive.

Literature is scanty on the impact of foreign aid for agriculture, however. While Islam (2011) provides an extensive review of analyses of the importance of foreign agricultural aid, a gap still remains regarding impact analysis of foreign agricultural aid. The present study intends to fill this vacuum.

3 Research Methodology

The data used for this study are essentially secondary in nature: foreign aid for agriculture (bilateral, multilateral, and total) and agricultural growth indicators (agricultural GD and agricultural productivity from 2002-2010 for 47 countries in SSA[6]. Foreign agricultural aid (actual disbursement flows) were obtained from the Organization for Economic Cooperation and Development's Development Assistance Committee (OECD/DAC) database,[7] and agricultural productivity (cereal yield), agricultural GDP, rainfall, and transparency indices were extracted from the World Bank's World Development Indicators (WDI, 2012). Government effectiveness data were obtained from Worldwide Governance Indicators (2012) as provided by the World Bank,[8] while natural disaster and conflict indicators were derived from the Center for Research on the Epidemiology of Disasters. Government effectiveness transparency indicators were included in the aid equation because the positive impact of foreign aid on economic growth is dependent on good economic policy (Alesina and Weder, 1999; de la Croix and Delavallade, 2013). The relevant data were analyzed using the Granger Causality test, Generalized Method of Moments (GMM), and Variance Decomposition methodologies. The analyses were conducted for total, bilateral, and multilateral foreign agricultural aid. Analysis of Variance (ANOVA) was also employed to test for significant differences in the average foreign agricultural aid received by West, East, South, and Central Africa[9].

The first stage of the analysis was the Granger Causality test of foreign agricultural aid on agricultural productivity and agricultural GDP. The Granger Causality test is a statistical hypothesis test that determines whether one time series is useful in forecasting another (Granger, 1969). Testing causality, in the Granger sense, involves using an F-test to test whether lagged information regarding foreign agricultural aid provides any statistically significant information about agricultural productivity and agricultural GDP in the presence of lagged agricultural productivity and agricultural GDP. If not, foreign agricultural aid does not Granger-cause agricultural productivity or agricultural GDP,[10] as the case may be.

[6] The list of the countries included is presented in Table 1.
[7] All the foreign agricultural aids are measured in Constant 2010 price USD in Million
[8] Available at http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=worldwide-governance-indicators
[9] Regional disaggregation of SSA is available at http://unstats.un.org/unsd/methods/m49/m49regin.htm#africa
[10] This was conducted stepwise to test for causality of bilateral, multilateral and total foreign agricultural aid on agricultural productivity and agriculture GDP) in SSA.

I combine time series of foreign agricultural aid and agricultural productivity and agricultural GDP across 47 countries in Sub-Saharan Africa to obtain a panel dataset that contains sufficient observations to estimate the following VAR model (422 observations):

$$LogFA_{it} = \beta_0 + \sum_{j=1}^{p} \beta_{1j} Log\text{FA}_{i t-j} + \sum_{j=1}^{p} \beta_{2j} \text{AG}_{i t-j} + \eta_i + \ell_{it} \qquad (1)$$

$$AG_{it} = \alpha_0 + \sum_{j=1}^{p} a_{1j} \text{LogFA}_{i t-j} + \sum_{j=1}^{p} a_{2j} \text{AG}_{i t-j} + \zeta_i + \mu_{it} \qquad (2)$$

where *FA* and *AG* are foreign agricultural aid[11] and agricultural productivity or agricultural GDP, respectively, while FA_{t-j} and AG_{t-j} represent values of the variables lagged *j* years; *p* is the maximum lag length[12], η_i, *and* ζ_i are country-specific effects that summarize the influence of unobserved variables (such as infrastructure, period average climate, soils, elevation, history, and culture) which are assumed to be distributed independently across countries, with variance $\delta^2_{\eta i}$ and $\delta^2_{\zeta i}$, ℓ and μ are error terms, and, βs and αs are parameters to be estimated. Given that ordinary least squares (OLS) and generalized least squares (GLS) will yield biased estimates in the presence of correlations between the country-specific effects and the lagged *FA* and *AG* variables, I employ a Generalized Method of Moments (GMM) estimator to obtain consistent parameter estimates (Holtz-Eakin et al., 1988). Differencing away the country-specific fixed effects and using current annual rainfall (RF_{it}), yearly dummy for Disasters/Conflict (D_{it})[13], Transparency Index[14] (T_{it}), Time trend (P_{it}), Governance Index (G_{it}),[15] and Weather Shock (W_{it})[16], I estimate the following equations:

$$Log(FA_{it}) = \beta_0 + \sum_{j-1}^{p} \beta_{1j} \log(FA_{it-j}) + \sum_{j-1}^{p} \beta_{2j} AG_{it-j} + \sum_{j-0}^{1} \beta_{3j} RF_{it-j} + \sum_{j-1}^{2} \beta_{4j} D_{itj} + \beta_{5j} T_{itj} + \beta_{6j} P_{itj} + \beta_{7j} G_{itj} + \beta_{8j} W_{itj} + \eta_i \quad (3)$$

$$AG_{it} = a_0 + \sum_{j-1}^{r} a_{1j} \log(FA_{it-j}) + \sum_{j-1}^{r} a_{2j} AG_{it-j} + \sum_{j-0}^{1} a_{3j} RF_{it-j} + \sum_{j-1}^{2} a_{4j} D_{itj} + a_{5j} T_{itj} + a_{6j} P_{itj} + a_{7j} G_{itj} + a_{8j} W_{itj} + \xi_i \quad (4)$$

[11] The impacts of bilateral, multilateral, and total foreign agricultural aid on agricultural productivity and agricultural GDP were treated separately in the analyses.

[12] The Lag Exclusion Wald Test was used to select the most appropriate lag length; a two year period was selected for Foreign Aid and Agricultural Productivity and Agricultural GDP and one year was selected for rainfall.

[13] D is a dummy variable for natural disaster, where 1 is for disaster period and zero otherwise.

[14] This measures transparency, accountability, and corruption in the public sector rating (1=low to 6=high) as estimated by World Bank in World Development Indicator, 2012.

[15] This measures the perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation and the credibility of the government's commitment to such policies. The estimate of governance ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance (Worldwide Governance Indicator (2012).

[16] I decided to use logarithm of foreign aid (FA) because the same amount of FA is likely to have larger effects on agricultural productivity for a small country than for a larger country. Log (FA) measures the percentage changes and it's thus scale-free.

In order to make foreign agricultural aid's net dynamic effects clearer, I compute variance decomposition functions to depict the time path of agricultural growth responses to a 1% one-year increase in foreign agricultural aid. This technique allows me to determine to what extent the forecast error variance for any variable in a system can be explained by innovations in each explanatory variable over a series of time horizons.

4 Results and Discussion of Descriptive Statistics

Table 1 shows that average agricultural aid to SSA between 2002 and 2010[17] was about 35 million USD. Equatorial Guinea received the least amount of agricultural aid (0.39 million USD), while Ethiopia received 126 million USD, the highest amount of agricultural aid during the period under consideration. Ethiopia is an aid-dependent country, with more than half of its government expenditures coming from foreign aid; Alabi and Adams (2012) show that Ethiopia[18] is also the highest food aid recipient in Africa. Bilateral agricultural aid varies from 0.34 million USD for Equatorial Guinea to about 63 million USD for Ghana, with an average of about 18 million USD for SSA as a whole. Likewise, multilateral agricultural aid varies between 0.15 million USD to about 18 million USD, with 17 million USD being the average. Equatorial Guinea the least multilateral agricultural aid received (0.15 million USD) while Tanzania received the largest share (89 million USD).

[17] Disaggregated agricultural aid commitment on country basis is available only for period between 2002 and 2010 as the time of this research.

[18] FAO (2006) reported that the prevalence of malnourishment in Ethiopia was 44%, which suggested that about 35 million people are malnourished in Ethiopia.

Table 1: Average of Foreign agricultural aid in SSA in Million USD (2002-2010)

COUNTRY	Total Agric Aid	Bilateral Agric Aid	Multilateral Agric Aid
1 Angola	17.81	13.89	3.92
2 Benin	30.43	16.17	14.26
3 Botswana	1.73	1.66	0.59
4 Burkina Faso	69.52	40.69	28.61
5 Burundi	16.09	4.61	11.49
6 Cameroun	37.82	21.34	16.48
7 Cape Verde	7.58	6.39	1.18
8 Chad	18.64	6.75	11.88
9 Central Africa Republic	11.05	9.82	1.84
10 Comoros	1.30	0.84	0.51
11Congo Dem	28.42	12.52	15.91
12 Congo Rep	2.46	1.67	1.02
13 Cote d' Ivoire	41.87	7.32	34.45
14 Djibouti	0.82	0.34	0.49
15 Equatorial Guinea	0.39	0.34	0.15
16Eritrea	13.76	6.04	7.72
17 Ethiopia	125.54	53.03	72.51
18 Gabon	9.04	8.16	0.99
19 Gambia	11.70	4.05	7.62
20 Ghana	100.93	63.43	37.46
21 Guinea Bissau	5.11	1.72	3.38
22 Guinea	19.58	14.29	5.28
23 Kenya	74.79	42.17	32.46
24 Lesotho	2.11	1.31	1.91
25 Liberia	5.59	3.20	3.59
26 Madagascar	66.39	30.47	35.92
27 Malawi	66.39	33.54	32.79
28 Mali	103.63	55.98	47.66
29 Mauritania	32.68	13.66	18.95
30 Mauritius	4.92	1.77	3.54
31 Mozambique	84.96	54.35	30.32
32 Namibia	9.51	7.94	1.57
33 Niger	44.67	20.90	23.77
34 Nigeria	28.76	7.90	23.47
35 Rwanda	36.27	18.68	17.59
36 Sao Tome	1.64	1.11	0.60
37 Senegal	66.01	48.23	17.69
38 Sierra Leone	11.50	5.31	6.19
39 Somalia	5.29	0.99	5.53
40 South Africa	15.83	14.98	1.52
41 Sudan	25.51	11.81	26.63
42 Swaziland	5.17	1.55	4.07
43 Tanzania	123.53	34.37	89.15
44 Togo	5.92	4.40	1.70
45 Uganda	96.51	37.75	58.76
46 Zambia	41.93	30.27	11.66
47 Zimbabwe	18.12	15.40	2.72
SSA Average	35.04	17.56	17.19
Maximum	125.54	63.43	89.15
Minimum	0.39	0.34	0.15

Sources: Computed by the Author

The results presented in Table 2 reveal that agricultural aid allocation in SSA varied from 6.45% in 2002 to 7.80% in 2009, the average being 7% of total sector-allocable aid. This is higher than the 4% estimated global average allocation to agricultural seen in 2006-2008 (Appendix 2). Table 2 further reveals that agricultural aid grew from 18 million USD in 2002 to about 47 million USD in 2010. The rate of growth of foreign agricultural aid is estimated to be 98%, only slightly less than the 99% growth of total sector-allocable aid in SSA. This implies that foreign agricultural aid is growing at almost the same pace as total foreign aid allocation in the region.

Table 2: Trend in Foreign Aid (Average) Disbursed to Agriculture in SSA (Constant 2010 USD millions)

Year	Total Sector Allocable	Agriculture Allocation	% Agricultural Aid
2002	268.08	18.22	6.80
2003	291.04	21.23	7.29
2004	333.28	22.76	6.83
2005	353.52	23.45	6.63
2006	392.45	25.83	6.58
2007	457.51	30.85	6.74
2008	510.79	32.93	6.45
2009	564.88	44.08	7.80
2010	611.74	46.62	7.62
Average	420.37	29.55	7.03
Maximum	611.74	46.62	7.80
Minimum	268.08	18.22	6.45
Percentage	100	7.03	-
Growth Rate (%)	99.7	97.9	-

Source: Computed by the Author

Table 3 shows that agricultural policy and administration comprised 22% of SSA's agricultural aid between 2002 and 2010; this compares favorably with the global average of about 26% (estimated by Islam, 2011; see Appendix 3). Far East Asia, on the other hand, devoted only about 17% of its agricultural aid to policy and administration management in 2005-2008, as estimated by Coppard (2009) and indicated in Appendix 4. Generally, there has been a global decline in agricultural aid allocation to policy and administration, possibly due to the fact that administrative costs can be abused or misappropriated by local and foreign aid administrators, thus increasing the effort and cost associated with ensuring aid effectiveness.

Agricultural development comprised about 25% of total agricultural aid in SSA in 2010, an increase from about 12% (Coppard, 2009) in 2002. This could be an appropriate level of allocation if the funds are used to improve soils[19], to buy improved seeds, and to supply farmers with appropriate new technologies. The global average allocation to agricultural development was 13% (Coppard, 2009), while allocation to agricultural development in Far East Asia was about 22%.

[19] For example, in Nigeria, only 5% of the land is classified as of good productivity. It is estimated that Nigeria is experiencing deteriorating annual nutrient depletion (Liverpool-Tasie, 2010), risking its ability to sustain the modest gains achieved from recent agricultural growth. Nutrient depletion in Nigeria (N.P. K) was estimated at 2.89 million tonnes, accounting for 35 percent of total depletion in Africa.

Capital constraint is a major challenge facing African farmers, and the allocation of 1.34 % of total agricultural aid to finance may not be able to adequately solve this problem.

Global agricultural aid allocation to agricultural finance was about 2% (see Appendix 4) in the period under consideration, suggesting the need to scale up agricultural finance in SSA. This becomes even more important when you compare SSA's 1.34% allocation with that of Far East Asia, which stands at about 3%.

The importance of research and development for agricultural growth and development cannot be overstated. Table 3 shows that about 9% of agricultural aid in SSA was allocated to research in the study period. This is an upward movement when you compare it with the global average of about 7% (Appendix 4); however, there is evidence of stagnation if this is compared with the 7% allocation estimated for SSA in 2005-2008. According to Beintema et al (2012), global agricultural R&D spending in both the public and private sectors steadily increased between 2000 and 2008;20 most of this growth was driven by developing countries, since growth in high-income countries stalled during this period. But spending growth in developing countries was largely driven by positive trends in a number of larger, more advanced middle-income countries such as China and India, masking negative trends in smaller, poorer, and more technologically challenged countries. Countries in this latter group are often highly vulnerable to severe volatility in funding, and hence in spending, which impedes the continuity and ultimately the viability of their research programs. Many R&D agencies in this group lack the necessary human, operating, and infrastructural resources to successfully develop, adapt, and disseminate scientific and technological innovations. Sufficient foreign aid allocation to R&D could go a long way toward filling these gaps.

According to IFPRI (2010)[21,] 6% of Africa's farmland is irrigated. In SSA, only 4% of the land is irrigated, compared to 37% in Asia. As a result, crops in Africa rely on rain, despite irregular and insufficient rainfall, frequent drought, and the existence of ample, untapped water resources[22]. Table 3 shows that about 8% of foreign agricultural aid was allocated to agricultural water resources in SSA, very close to the 9% estimated by Coppard (2009). However, this is less than the 29% allocation to water resources in Far East Asia; South/Central Asia allocated about 36% of its agricultural aid to water resources, which, according to Islam (2011), may partly explain the agricultural revolution Asia witnessed.[23]

[20] http://www.ifpri.org/publication/asti-global-assessment-agricultural-rd-spending?utm_source=New+At+IFPRI&utm_campaign=1b04933cd3-New_at_IFPRI_11_1_2012&utm_medium=email

[21] Available on the internet at http://www.ifpri.org/blog/irrigating-africa

[22] Because irrigated crop yields are double or more than comparable rainfed yields, tapping into this irrigation potential is essential for boosting the continent's agricultural productivity—the lowest in the world. Africa Infrastructure Country Diagnostic (AICD) reports that per capita agricultural output in Africa is 56 percent of the world average. According to an FAO study, nearly 60 percent of Sub-Saharan Africa's rural population could benefit from water investment.

[23]Coppard (2009) has shown that the share of water resources in agriculture foreign aid were 9%, 36%, 27% and 34% for SSA, South/ Central Asia, Far East Asia and world respectively.

According to a recent post-harvest report in Africa[24], in Kenya alone, annual post-harvest losses for crops like bananas were estimated to be more than 50%; this figure is often even higher in other parts of Africa. In Nigeria, the second biggest economy in SSA, losses easily exceed one-third for many crops. Foreign assistance should focus on ameliorating this problem; however, Table 3 reveals that only 0.96% of foreign agricultural aid was allocated to plant/post-harvest loss and processing in SSA from 2002-2010.

Table 3: The Average Utilization of Foreign agricultural aid (Constant 2010 USD millions) in SSA and Far East Asia[25](2002 to 2010)

	Sub-Sahara Africa			**Far East Asia**		
Utilization	**Mean**	**%**	**Standard Deviation**	**Mean**	**%**	**Standard Deviation**
Agrarian Reform	5.18	0.35	2.58	8.50	1.65	5.13
Cooperative	21.56	1.46	7.39	1.39	0.27	0.84
Agricultural Development	366.08	24.78	148.68	111.85	21.66	33.69
Agric Extension	65.69	4.45	15.12	9.53	1.85	2.13
Agric Finance	19.85	1.34	17.04	15.30	2.96	16.41
Agric Input	78.02	5.28	89.78	15.52	3.00	11.09
Agric Policy and Administration	318.69	21.57	145.83	45.08	8.73	20.01
Agric Research	125.94	8.52	86.75	30.45	5.90	29.78
Agric Service	59.86	4.05	20.24	3.76	0.73	1.96
Training	23.95	1.62	16.31	4.71	0.91	1.29
Alternative Development	7.53	0.51	12.72	1.89	0.37	1.73
Export Crop Production	36.17	2.45	42.03	7.60	1.47	7.16
Food Crop Production	111.11	7.52	29.95	16.86	3.26	7.03
Land Development	55.27	3.74	13.17	68.63	13.29	31.99
Livestock	55.99	3.72	9.36	12.28	2.38	2.97
Post Harvest and Processing	11.18	0.96	7.11	3.09	0.60	1.40
Veterinary	7.63	0.52	3.47	9.71	1.88	6.45
Agricultural Water Resources	108.92	7.57	33.18	150.24	29.09	77.48
Total Agric aid	1477.60	100.00	503.23	516.43	100.00	101.51

Source: Computed by the Author

The causality test presented in Table 4 indicates that there is neither uni-directional nor bi-directional causality between total foreign agricultural aid and agricultural productivity in SSA. It also reveals that total foreign agricultural aid does not influence agricultural contribution to GDP in the region. However, when disaggregated into bilateral and multilateral foreign agricultural aid, I find that multilateral foreign aid influences agricultural GDP and bilateral aid influences agricultural productivity. This is in

[24]Available on the internet at http://www.modernghana.com/news/275240/1/africas-agricultural-postharvest-losses-offer-oppo.html

[25] The countries in the Far East Asia are listed in Appendix 1

accordance with the expectation of Njeru (2003), who was of the opinion that the economic effect of foreign aid may be different when disaggregated into bilateral and multilateral aid. Bilateral aid may significantly influence agricultural productivity because it may be more tangential to the particular agricultural sectors and/or and subsectors that directly affect productivity factors. For instance, there may be an urgent need for specific assistance in a recipient country (e.g, an irrigation project), and bilateral aid may be given for that particular purpose. If this type of aid is well used for the intended purpose, it may have more impact on productivity than aid that is not tied to a particular purpose.

Table 4 also reveals that multilateral foreign agricultural aid influences agricultural GDP in SSA, possibly implying that countries with higher agricultural GDP may receive more multilateral foreign agricultural aid. This result may also suggest that efforts to increase agriculture contributions to GDP can lead to more foreign assistance from multilateral donors; Driffield and Jones (2012) have indicated that countries with higher GDP growth can attract more foreign aid. Countries that support their own agricultural growth may also expect to receive more international support from multilateral agencies.

Table 4: Pair-wise Granger Causality of Foreign Aid, Agricultural Productivity, Agricultural Production and Agriculture GDP in SSA

Null Hypothesis	Observation	F-Statistic	Probability
Log total Agric. foreign aid does not cause Agric. productivity	398	1.0639	0.3461
Agric. Productivity does not cause Log total Agric foreign aid		0.0839	0.9195
Log total Agric. foreign aid does not cause Agriculture GDP	305	0.5103	0.6008
Agriculture GDP does not cause Log total Agric foreign aid		2.0045	0.1365
Log Multilateral Agric. foreign aid does not cause Agric. productivity	313	0.2256	0.7982
Agric. Productivity does not cause Log Multilateral Agric. Foreign		0.3702	0.6909
Log Multilateral Agric. foreign aid does not cause Agriculture GDP	243	2.4156**	0.0915
Agriculture GDP does not cause Log Multilateral Agric. Foreign		2.0035	0.1371
Log Bilateral Agric. foreign aid does not cause Agric. productivity	398	2.7221**	0.0670
Agric. Productivity does not cause Log Bilateral Agric. Foreign		0.1088	0.8870
Log Bilateral Agric. foreign aid does not cause Agriculture GDP	305	0.3735	0.6887
Agriculture GDP does not cause Log Bilateral Agric. Foreign		2.5051**	0.0834

Source: Computed by the Author**Significant at 10%

5 Results and Discussion of Econometric Analyses

The test for variable Stationarity using both individual and common unit root process tests indicates that variables are stationary at the levels reported in Appendix 5. These tests assume a null hypothesis of the unit root. The Cointegration result presented in Appendix 6 reveals that a long-run relationship exists between foreign aid and agricultural productivity, as indicated by Trace Statistics and Max-Eigen Statistics. The impact of foreign agricultural aid on agricultural productivity was also estimated using a GMM approach.

5.1 The Impact of Total, Bilateral and Multilateral Agricultural Aid on Agricultural Productivity

The GMM estimates presented in Table 5 reveal that the Wald Test values for joint significance of lagged foreign agricultural aid and agricultural productivity equations are 3.54 and 729.00, respectively. The two values are significant at 5% in explaining foreign agricultural aid and agricultural productivity equations in SSA. Some of the factors that may influence agricultural productivity but that are not captured in the foreign aid equation are the stage of a country's economic development, soil fertility, and geography. Appendix 7 reveals that the amount of aid received by landlocked SSA countries is significantly higher than the average for SSA as a whole. A report by the UN Economic and Social Commission for Asia and the Pacific (1999) indicated that, due to their geographical position, these landlocked countries could benefit from foreign assistance, as it may fill the gap in trade that they experience relative to countries with easier access to international trade[26].

Table 5 also shows that past foreign aid (lagged one year) has a significant and positive relationship with current aid receipt (significant at 5%). This implies that a country that received aid last year, all things being equal, has a greater chance of receiving aid in the current year. Similarly, the table reveals that Disaster/Conflict has a positive and significant relationship (at 5% significance level) with aid receipt, suggesting that foreign agricultural aid also responds to disasters and conflicts in the region.

The time trend is also positive and significant at 5%, implying that aid receipt is growing over time. While past rainfall is significant and positively related with total foreign agricultural aid at 5%, the variability of rainfall captured as a weather shock has a significant but negative relationship with total foreign agricultural aid. The current rainfall also has a negative relationship with total foreign agricultural aid, but the relationship is weak and is only significant at 10%. Governance indicators such as transparency and government effectiveness are positively related with total agricultural aid, but the relationship is not significant, implying that they may not be important determinants of foreign agricultural aid receipt. This is in accordance with the finding of Alesina and Weder (2002), who document that there is no evidence that less corrupt governments receive more foreign aid. De la Croix and Delavallade (2013) reveal that corrupt countries may even receive more foreign aid because they are also the poorest countries. However, the fact that the transparency index is positive may suggest that transparency can contribute positively to aid receipts in the region. In fact, ODI (2006) indicates that many donors already consider governance issues, as part of a range of factors, in allocating aid.

Table 5 shows that the major positive determinants of agricultural productivity are past total agricultural aid (lagged 2 years), past agricultural productivity (lagged one year), current rainfall, time, and governance index; past rainfall, although significant in explaining agricultural productivity in SSA, is negatively related with current agricultural productivity.

[26] The specifically mentions the positive relationship between aid and growth in landlocked countries, noting their trade disadvantage (Available at http://www.unescap.org/55/e1140e.htm).

Lagged total foreign agricultural aid is significant at 10%, meaning that the influence of past foreign aid on agricultural productivity is mild and that productivity can improve as the volume of aid increases, as well as across time. The fact that it is the two-year lagged agricultural aid that is significant in explaining agricultural productivity implies that the influence of agricultural aid on agricultural productivity is not instantaneous. The agricultural productivity equation in Table 5 also reveals that past agricultural productivity (lagged 1 year) is positive and significant at 5%. This suggests that agricultural productivity over the past year has a positive influence on current agricultural productivity.

Current rainfall has a positive and significant relationship (at 5%), while past rainfall (lagged one year) has a negative but significant relationship (at 10%) with agricultural productivity. While the fact remains that too much or too little rainfall is not conducive for agricultural productivity, the most important factor for agricultural production is the variability of rainfall. Schulze et al (1997) reveals that the average precipitation need not necessarily be a constraint to successful agriculture, but variable rainfall can significantly affect the crop yield. This variability is captured as a weather shock in the agricultural productivity equation in Table 5. This table shows that although the coefficient of the weather variability is not significant, it is negative. Appendix 8 shows that weather shocks vary significantly in SSA, East Africa and Central Africa, and IFPRI (2011) indicates that climate change could substantially reduce yields from rain-fed agriculture in some countries[27].

The positive and significant trend between agricultural productivity and time indicates that agricultural productivity increases over time. However, IFPRI (2011) reveals that Africa has experienced continuous agricultural growth during the last few years, much of which has stemmed from an expansion in area devoted to agriculture rather than an increase in land productivity. In most countries, future sustainable agricultural growth will require a greater emphasis on productivity growth as suitable area for new cultivation declines, particularly given growing concerns about deforestation and climate change.

The transparency index does not have a significant relationship with agricultural productivity, but the governance index exhibits a positive relationship with agricultural productivity that is significant at 10%. This reveals that although the effect of governance on agricultural productivity is mild, a country that has good governance performance in terms of the quality of policy formulation and implementation and the credibility of the government's commitment to such policies has higher agricultural productivity. This may also implies that good governance can enhance agricultural aid effectiveness in SSA, as indicated by various scholars (Knack, 2001; Collier and Dollar, 2001).

According to Njeru (2003), bilateral and multilateral foreign aid can have a differentiated impact of the economy of developing countries. I tested the separated impacts of bilateral and multilateral foreign agricultural aid on agricultural productivity in SSA; the result is reported in Table 5. First I tested for

[27] This is a note on international conference on increasing agricultural productivity and enhancing food security in Africa. Available on the internet at http://www.ifpri.org/sites/default/files/20111101productivityconf_cn.pdf

the difference in significance between bilateral and multilateral agricultural aid in SSA. The result of the test as presented in Appendix 9 suggests that, though the amount of bilateral aid was higher than multilateral aid, there is no significant difference between the two forms of aid.

Table 5 indicates that bilateral aid has a significant relationship (at 10%) with agricultural productivity, while multilateral aid has no significant relationship with agricultural productivity. The reason for this differentiated impact may be due to the fact that bilateral aid is usually higher than multilateral aid. The OECD estimates that in 2008, only about 40% of Official Development Assistance (ODA), or nearly US$50 billion, from Development Assistance Committee (DAC)[28] countries was channeled through multilateral institutions and funds. The estimated proportion of bilateral agricultural aid to total agricultural aid in SSA is 55%, as reported in Appendix 9. This shows that scaling up agricultural aid may increase the impact of such aid on agricultural productivity in SSA.

Another variable of interest is the governance index. The governance index coefficient is not significant in the bilateral aid agricultural equation, but it is significant in the multilateral agricultural aid equation, which implies that the issue of governance may be a more important consideration for the receipt of multilateral aid than the bilateral aid. Multilateral aid is delivered though international institutions such as the various agencies of the United Nations, World Bank, and Asian Development Bank; these may place a higher premium on governance than bilateral donors.

[28] The Development Assistance Committee (DAC) is one of the key forums in which the major bilateral donors work together to improve the effectiveness of their common efforts to support sustainable development.

Table 5: GMM Estimates of Impact of Agriculture Total, Bilateral and Multilateral Aid on Agricultural Productivity in SSA

	Total Agric Aid Foreign Aid		**Bilateral Agric Foreign Aid**		**Multilateral Agric Foreign Aid**	
Variable	Log Agric Foreign Aid	Agric Productivity	Log Agric Foreign Aid	Agric Productivity	Log Agric Foreign Aid	Agric Productivity
Constant	0.7170 (1.1946)	98.5571(0.5130)	0.3206(0.5102)	137.5706(0.6995)	0.8339(1.10079)	1.8183(0.0090)
Log Agric Aid ($_{-1}$)	0.6329(7.7351)*	16.1323 (0.9225)	0.5828(7.8362)*	26.3525 (1.4413)	0.5806(8.5318)*	3.8387(0.2894)
Log Agric Aid ($_{-2}$)	0.0694(1.0329)	24.3453(1.7303)**	0.1144(1.7989)**	23.1260(1.6391)**	0.0614(0.8101)	20.3643(1.2466)
Agric Productivity($_{-1}$)	0.0002(1.7060)**	0.6259(6.7267)*	0.0002(-1.2771)	0.6311(6.9523)*	0.0004(1.9054) **	0.6013(0.9532)
Agric Productivity($_{-2}$)	0.0001(0.3838)	0.0146(0.3148)	0.0001(0.1423)	0.01610(0.3456)	0.0002(0.7866)	0.0103(0.1347)
Rainfall	-0.0006(-1.8618) **	0.4723(3.4739)*	-0.0007(-2.3542)*	0.4771(3.5343)*	-0.0006(-1.2431)	0.4956(3.5527)*
Rainfall(-1)	0.0007(2.4251)*	-0.2550(1.9036) **	0.0008(2.8208)*	-0.2661(-2.0326)	0.0001(1.8488) **	-0.2684(-1.8100) **
Disasters/Conflicts	0.4352(3.5132)*	-9.3548(-0.22641)	0.4673(3.5461)*	1.6150(0.0405)	0.4569(3.0296)*	-29.6457(-0.6139
Transparency Index	0.0337(0.2452)	25.2039(0.5333)	0.0962(0.6606)	25.4860(0.5289)	-0.0479(-02273)	43.1198(0.8518)
Time	0.0892(3.0663)*	25.5714(2.2512)*	0.0854(3.0575)*	25.3252(2.2243)*	0.1115(2.7474) *	28.9280(2.2815)*
Governance Index	0.2952(1.3250)	95.9826(1.6044)**	0.2333(0.9956)	107.2767(1.7263)**	0.5342(1.8854)**	41.9520(0.7324)
Weather Shock	-0.2908(-2.4912)*	-58.8699(-1.3925)	-0.3084(-2.9777)*	-66.2285(-1.5561)	-0.2856(-1.7817) **	-71.8691(-1.6667)**
Wald Tests for Joint Significance						
Lagged Agric Aid		3.54*		3.35*		1.80**
Lagged Productivity	729.00*		729.00*		729.00*	729.00*
Rainfall	1008.00*	1008.00*	1007.00*	1007.00*	1008.00*	1008.00*
Lagged Rainfall	1007.00*	1007.00*	1006.00*	1006.00*	1007.00*	1007.00*
Disasters/Conflicts	-4.00*	-4.00*	5.00*	5.00*	4.00*	4.00*
Transparency Index	-2.500*	-2.500*	3.00*	3.00*	2.5.00*	2.5.00*
Time	3.00*	3.00*	2.00*	2.00*	3.00*	3.00*
Governance Index	-8.13*	-8.13*	8.13*	8.13*	8.13*	8.13*
Weather Shock	-7.91*	-7.91*	-8.91*	-8.91*	-8.91*	-8.91*

Source: Author's Computation* Significant at 5%. ** Significant at 10% Figures in Parenthesis are the t-Statistics

The Variance Decomposition results presented in Table 6 support the fact that the impact of foreign agricultural aid on agricultural productivity increases over time. The table shows that if foreign agricultural aid increased by 100% this year, there would be a 0% increase in agricultural productivity in the same year. However, this would translate into a 151% increase in agricultural productivity over a 10-year period. Thus, recent advocacy for an increase in foreign agricultural aid may be justified on the grounds that it has long-term effects on agricultural productivity.

Table 6: Variance Decomposition of Foreign agricultural aid and Agricultural Productivity in SSA

Period	Foreign agricultural aid	Agric Productivity
1	100.00	0.00
2	99.61	0.39
3	99.30	0.70
4	99.04	0.96
5	98.84	1.16
6	98.70	1.30
7	98.61	1.39
8	98.55	1.45
9	98.52	1.50
10	98.49	1.51

Source: Computed from OECD Stat (2012) and WDI (2012)

5.2 The Impact of Agriculture Total, Bilateral and Multilateral Aid on Agriculture GDP

The test for variable Stationarity using both individual and common unit root process tests indicates that the variables used in the foreign agricultural aid and agricultural GDP equations are stationary at levels reported in Appendix10. These tests assume a null hypothesis of a unit root. The Cointegration result presented in Appendix 11 reveals that a long-run relationship exists between foreign aid and agricultural GDP, as indicated by Trace Statistics and Max-Eigen Statistics in Appendix 11. I then proceeded to estimate the impact of foreign aid on agricultural GDP using a GMM methodology.

The GMM estimates presented in Table 7 reveal that the Wald Test values for joint significance of lagged foreign agricultural aid and agricultural GDP equations are 3.55 and 5.64, respectively. The two values are significant at 5% in explaining the impact of foreign agricultural aid on agricultural GDP in SSA. Table 7 also shows that past foreign aid has a significant and positive relationship with current aid receipts (significant at 5%). This is significant at 5% and 10% when lagged for one year and two years, respectively, implying that a country that received aid last year, all things being equal, has a greater chance of receiving aid in the current year. Past agricultural GDP (lagged one year) has a positive and significant relationship (at 10%) with foreign agricultural aid receipts. Current and past rainfall does not have a significant relationship with aid receipts. The table also reveals that Disaster/Conflict has a positive and significant relationship (at 5% significance) with the aid receipts, which suggests that foreign agricultural aid also responds to disasters and conflicts in SSA. The time trend is also positive and significant at 5%, implying that aid receipts are growing over time.

The governance and transparency indices are positively related with total agricultural aid, but these relationships are not significant. This implies that they may not be important determinants of agricultural aid receipts in SSA. Weather variability, measured as weather shocks, has a significant but negative relationship with foreign agricultural aid. This may be due to the fact the weather variability can aggravate natural disasters, possibly leading to the receipt of more foreign agricultural aid.

Table 7 shows that the major positive determinants of agricultural GDP are past total agricultural aid (lagged 1 year) and past agricultural GDP (lagged 1 year). The lagged total foreign agricultural aid is significant at 10%, meaning that the influence of past foreign aid on agricultural GDP is mild and can improve as the volume of aid increases, as well as over time.

The agricultural GDP equation in Table 7 also reveals that past agricultural GDP (lagged 1 year) is positive and significant at 5%, suggesting that agricultural GDP in the past year has a positive influence on current agricultural GDP. The time trend coefficient is significant but has a negative relationship with agricultural GDP, suggesting that agricultural GDP is declining in SSA and also that the contribution of agriculture to the economy is declining over time. Other scholars have pointed out that African countries have not put high priority on agriculture, which may explain the decline (Calestous, 2011). It has also been suggested that the current leap-frogging of African economies from agriculture to services is inconsistent with the employment requirements and food security needs of the continent[29]. Since agriculture is also a major stepping stone for industrialization in SSA, scaling up agricultural expenditures could raise productivity and feed industry with raw materials (Lowder and Carisma, 2011). The transparency and governance indices have a positive relationship with agricultural GDP, but the relationship is not significant.

The analysis of the differentiated impacts of bilateral and multilateral foreign aid on agricultural GDP in SSA is also reported in Table 7. The table indicates that multilateral aid (lagged one and two years) has a significant relationship (at 10% and 5%) with agricultural GDP, while bilateral aid has no significant relationship with agricultural GDP. These results may indicate that it is not only the amount for aid that can influence agriculture, but that the nature, origin, and purpose of the aid can be of importance. Morrissey (1990) indicates quite strongly that multilateral aid generates greater benefits both in volume terms and per equivalent amount of aid expenditure. He concludes that the case for the increased use of tied bilateral aid is weaker than commonly supposed. This finding also highlights the fact that countries with higher agricultural GDP attract more multilateral aid than countries with lower agricultural GDP. The debate over which type of aid is better is still inclusive.[30]

While bilateral agricultural aid can influence agricultural productivity more than multilateral agricultural aid, multilateral aid can influence the contribution of agricultural output to the economy more than bilateral agricultural aid. Another significant variable in agricultural GDP under both bilateral

[29] Available at http://triplecrisis.com/agriculture-for-africas-development-in-search-for-a-champion/
[30] http://www.owen.org/blog/6128

and multilateral agricultural aid, apart from the lagged agricultural GDP, is the time trend. The time trend is significant and negatively related to current agricultural GDP, which suggests a declining trend in agriculture's contribution to GDP in SSA. This trend reflects the lower priority given to agriculture in terms of policies and financing (World Bank, 2007).

Table 7: GMM Estimates of Impact of Agriculture Total, Bilateral and Multilateral Aid and Agriculture GDP in SSA

	Total Agric Aid Foreign Aid		**Bilateral Agric Foreign Aid**		**Multilateral Agric Foreign Aid**	
Variable	**Log Agric Foreign Aid**	**Agric GDP**	**Log Agric Foreign Aid**	**Agric GDP**	**Log Agric Foreign Aid**	**Agric GDP**
Constant	0.3691(0.5235)	6.2492(1.4737)	0.1694(0.2292)	5.2985(1.2519)	0.6870(0.7565)	7.4098(1.4274)
Log Agric Aid ($_{-1}$)	0.5763(5.4445)*	0.7141 (1.7225) **	0.5185(5.3911)*	0.1221 (0.2307)	0.5820(8.0485)*	0.6802(1.9239)*
Log Agric Aid ($_{-2}$)	0.1341(1.6236) **	0.4424(1.5554)	0.2155(2.8495)*	0.3353(0.9918)	0.0248(0.3096)	0.8314(2.0797*
Agric GDP ($_{-1}$)	0.01423(1.6209) **	0.7972(12.8344)*	0.0137(1.5870)	0.8192(12.2552)*	0.0136(1.1383)	0.8195(13.3214)*
Agric GDP ($_{-2}$)	0.0060(0.7235)	0.0109(0.2464)	0.0073(0.8266)	0.0119(0.2399)	0.0050(0.4577)	0.0009(0.0170)
Rainfall	-0.0006(-1.2341)	-0.0024(0.4586)	-0.0007(-1.6330) **	0.0022(0.4462)	-0.0006(-0.6885)	0.0036(0.6136)
Rainfall(-1)	0.0006(1.2312)	0.0017(0.3454)	0.0004(1.5763)	-0.0016(-0.3184)	0.0007(0.8633)	-0.0030(-0.5163)
Disasters/Conflicts	0.3707(2.7325)*	-0.2241(0.2360)	0.4384(2.9879)*	0.1647(0.1752)	0.4356(2.6292)*	0.1691(0.1557)
Transparency Index	0.0609(0.3770)	0.1520(0.1540)	0.1444(0.8482)	0.2883(0.2876)	-0.0633(-0.2747)	-0.0830(-0.0759)
Time	0.0842(2.3411)*	-0.7144(-2.5934)*	0.0823(2.5242)*	-0.6862(-2.4881)*	0.1020(2.0186)*	-0.5981(-2.1250)*
Governance Index	0.2421(0.8027)	2.0823(1.0636)	0.1221(0.4094)	2.4026(1.2320)	0.5938(1.6929) **	-1.2920(0.6506)
Weather Shock	-0.3266(-2.0651)*	-0.9296(-0.8477)	-0.3371(-2.4968)*	-1.0480(-0.9336)	-0.2819(-1.2996)	-0.7489(-0.6957)
Wald Tests for Joint Significance						
Lagged Agric Aid		3.55*		3.35*		1.79*
Lagged Agric GDP	5.64*		5.64.00*		5.64*	8.84*
Rainfall	1008.00*	1008.00*	1008.00*	1008.00*	1008.00*	1008.00*
Lagged Rainfall	1007.00*	1007.00*	1007.00*	1007.00*	1007.00*	1007.00*
Disasters/Conflicts	-4.00*	-4.00*	-4.00*	-4.00*	4.00*	4.00*
Transparency Index	-2.500*	-2.500*	-2.50*	-2.50*	2.5.00*	2.5.00*
Time	3.00*	3.00*	3.00*	3.00*	3.00*	3.00*
Governance Index	-8.13*	-8.13*	-8.13*	-8.13*	8.13*	8.13*
Weather Shock	-7.91*	-7.91*	-7.91*	-7.91*	-7.91*	-791*

Source: Author's Computation* Significant at 5%. Figures in Parenthesis are the t-Statistics

The Variance Decomposition results presented in Table 8 support the fact that the impact of foreign agricultural aid on agricultural GDP increases over time. The table shows that if foreign agricultural aid increased by 100% this year, there would be a 0% increase in agricultural GDP in the same year. However, this increase would translate to about a 320% increase in agricultural GDP over 10-year period. Thus, an increase in foreign agricultural aid may be justified on the grounds that it can have long-term effects on agricultural GDP.

Table 8: Variance Decomposition of Foreign agricultural aid and Agriculture GDP in SSA

Period	Agric Foreign Aid	Agric GDP
1	100.00	0.00
2	98.73	1.27
3	98.33	1.67
4	97.91	2.09
5	97.60	2.40
6	97.34	2.66
7	97.15	2.85
8	97.00	3.00
9	96.89	3.11
10	96.80	3.20

Source: Computed from OECD Stat (2012) and WDI (2012)

5.3 Regional Consideration in Agricultural Aid, Agricultural Productivity and Agricultural GDP in SSA

Table 9 indicates that there are significant differences in per-country foreign agricultural aid receipts based on region. The table shows that the average agricultural aid received (total, bilateral, and multilateral aid) per country in East Africa was higher than the other regions in SSA, which may be attributed to the fact that there were more cases of natural and man-made disaster in East Africa than in any other. Table 9 reveals that, on average, East African countries experienced disaster/conflict about 37% of the time from 2002-2010. This is higher than the 26%, 20%, and 20% estimated for Central, South, and West Africa, respectively.

SSA's estimated average agricultural productivity is about 1207kg/ha, far lower than the 3373kg/ha estimated as the average for Far East Asian countries (see Appendix 1). Many factors have been implicated in the region's low agricultural productivity. According to Crawford et al (2005), average fertilizer use in SSA (21kg/ha) is much lower than elsewhere in the world (86 kg/ha in Latin America, 104 kg/ha in South Asia, and 142 kg/ha in Southeast Asia). The average fertilizer use for Sierra Leone, Central African Republic, and Rwanda was even lower, at 0.3kg[31]. Given the strategic importance of fertilizers in increasing agricultural productivity and ending hunger, the African Union Member States have resolved to increase the level of fertilizer use to an average of at least 50 kilograms per hectare by 2015 (AfricaFertilizer, 2010).

[31] http://www.nationmaster.com/graph/agr_fer_use-agriculture-fertilizer-use

According to Calestous (2011), Africa's agricultural productivity development strategy will need a champion both a stronger policy strategy and a renewed focus on financing. From a policy perspective, there is a need to urgently reverse the past decades' marginalization of agriculture. In terms of resource allocation, from 1986-2007, expenditures on agriculture as a share of GDP in SSA declined by half from 2.8% to 1.3%. This trend needs to be reversed in order to promote agricultural productivity in SSA.

Table 9 further shows that per-country agricultural productivity varies from about 1153kg/ha in West Africa to about 1222kg/ha in East and Central Africa, with an average of 1207kg/ha. This is far lower than the average for Far East Asian Countries, 3373kg/ha. The World Bank (2010) indicates that an increase in agriculture productivity in SSA will reduce poverty in the region more than a similar increase would do in any other region in the world. Such an increase would also reduce malnutrition in the region.

Agricultural GDP is higher in West Africa than in any other region in Sub-Sahara Africa, reflecting the fact that the economy of West Africa is more agrarian. Table 9 reveals that agricultural GDP in West Africa is about 30%, higher than the 29%, 19%, and 7% averages in East, Central, and South Africa, respectively. The average agricultural GDP estimated in this study for SSA as a whole is 25%[32], suggesting that agriculture is an important sector in terms of employment and income generation. This also indicates that agricultural assistance will go a long way toward improve the economy of the entire region.

Weather variability, as measured as a weather shock, in Table 9 indicates that there are significant differences across the region, with more variability seen in Central Africa (1.11, which is far higher than the average of 0.77 for SSA as a whole). This high weather variability may necessitate increased use of irrigation to reduce dependence on rainfall. However, available evidence suggests that only 1% of land in SSA is irrigated on average. In Congo Democratic, Uganda, and Central African Republic, only 0.14%, 0.12%, and 0.10% of land is irrigated, respectively[33].

Table 9 also reveals that the governments in South Africa are more effective in implementing policies and are more transparent. The least effective and transparent countries seem to lie in Central Africa. As discussed previously, issues of governance and transparency are becoming an important consideration in foreign aid receipts, as they are germane to aid effectiveness.

[32] This varies from about 2% for Botswana to about 55% for Central Africa Republic.
[33] http://www.nationmaster.com/graph/agr_irr_lan_of_cro-agriculture-irrigated-land-of-cropland

Table 9: Analysis of Variance of Regional Means of Some Selected Variables

Regions	Log Agric Total Aid	Log Agric Bilateral Aid	Log Agric Multilateral Aid	Disaster (%)	Agric Productivity	Agric GDP	Weather Shock	Transparency Index	Gov Index
Central Africa	1.70	1.20	0.81	26.25	1221.82	19.15	1.11	2.53	-1.17
South Africa	1.27	0.92	0.10	20.20	1207.24	6.53	0.77	3.50	0.04
West Africa	2.71	2.00	1.84	20.20	1152.87	29.48	0.76	2.90	-0.75
East Africa	2.96	2.18	2.36	37.24	1221.82	29.12	0.53	2.83	-0.79
F-Value	18.53*	10.67*	19.52*	3.99*	0.22	45.19*	15.90*	10.70*	50.20*

Source: Computed by the Author * Significant at 5%

6 Conclusion and Recommendations

This study shows that the average agricultural aid to Sub-Saharan Africa between 2002 and 2010 was about 35 million USD. Equatorial Guinea received the least amount of agricultural aid (0.39 million USD), while Ethiopia received 126 million USD, the highest amount of agricultural aid during the period under consideration. The study also reveals that agricultural aid allocation to the region varied from 6.45% in 2002 to 7.80% in 2009, with the average being 7% of total sector allocable aid during the period under consideration. Agricultural development and agricultural policy/administration shared about 25% and 22% of total aid, while about 9%, 8%, 1%, and 1% of total aid was allocated to research, water resources, agricultural finance, and postharvest loss/processing, respectively. I also find that the amounts of aid received by landlocked countries are significantly higher than the average received by the region as a whole, possibly because these countries are at trade disadvantage due to their location.

The econometric analysis suggests that foreign agricultural aid has a positive and significant impact on agricultural GDP and agricultural productivity at the 10% significance level. My results also show that disaster/conflict have a positive and significant impact on aid receipts at the 5% significance level, implying that aid responds to disaster and conflicts in the region. The transparency index has a positive but non-significant relationship with foreign agricultural aid, agricultural GDP, and agricultural productivity, but the governance index has a positive and significant relationship with agricultural productivity at the 10% significance level. The study also reveals that bilateral foreign agricultural aid influences agricultural productivity more than multilateral foreign agricultural aid, while multilateral foreign agricultural aid influences agricultural GDP more than bilateral foreign agricultural aid. This means that while bilateral agricultural aid can be more influential for agricultural productivity, multilateral aid can have greater influence on agriculture's contribution to the economy than the bilateral agriculture aid. This finding may indicate that it is not only the amount of aid that can influence agriculture, but that the nature, origin, and purpose of the aid can be important in measuring its impact. The governance index coefficient is not significant in the bilateral agricultural aid equation, but it is significant in the multilateral agricultural aid equation, which implies that issues of governance may be more of importance for the receipt of multilateral aid.

It will be important to scale up foreign agricultural aid in order to increase its impact on agricultural productivity and its contribution to the economy of SSA. However, the sectoral foreign agricultural aid allocation should give priority to factors that will enhance agricultural productivity in SSA. For instance, the allocation to water resources should be increased from its current level of 8% in order to increase the arable land irrigated in the region, which currently stands at 4%. Similarly, less than 1% of foreign agricultural aid is allocated to plant/post-harvest loss in SSA; this amount should be increased as well. The scaling up of aid for R&D will also be important in developing improved seeds and assisting farmers to adopt enhanced technologies. In all, a good synergy must be established between

foreign agricultural aid and domestic government expenditures on agriculture in order to emphasize these critical aspects of agriculture in the region.

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Appendix 1: Average Cereal Productivity (kg/ha) in Far East Asia (2002 -2010)

Year	**Brunei**	**Cambodia**	**China**	**Indonesia**	**Korea Rep**	**Korea Dem Rep**	**Laos**	**Malaysia**	**Mongolia**	**Philippines**	**Thailand**	**Timor-Leste**	Vietnam
2002	729.4	1922	4889.7	4169.5	6087.3	3326.9	3244.5	3232.1	588.4	2730.6	2960.2	1667.2	4441.0
2003	792.8	2160.6	4877.7	4248.1	5728.7	3452.2	3116.7	3347.2	797.9	2823.4	2954.5	1443.4	4506.7
2004	819	2024.8	5189.7	4274.5	6496.7	3547.0	3261.4	3314.9	802.6	2992.3	2921.2	1562.7	4690.9
2005	872.8	2508.7	5225.5	4311.3	6376.2	3481.3	3577.2	3407.0	480.7	3049.0	3005.8	1541.9	4726.2
2006	1223.5	2533.1	5313.4	4365.8	6401.4	3693.0	3634.4	3389.4	1098.0	3180.8	2966.8	1503.4	4749.8
2007	1115.9	2677.3	5319.8	4464.8	6109.3	3033.6	3837.3	3540.6	942.5	3319.8	3045.9	1276.1	4846.1
2008	1221.3	2804.8	5547.6	4694.3	7072.8	3716.3	4015.5	3599.2	1382.8	3334.3	3020.8	1442.7	4897.6
2009	1291	2938.6	5449.7	4812.7	7265.0	3512.7	4170.1	3676.7	1551.8	3228.9	2961.3	2315.5	5080.1
2010	1272.7	3108.3	5520.6	4875.7	6196.3	3582.0	3750.5	3799.9	1370.1	3231.9	2938.5	2451.4	5160.7
Average	1037.6	2519.8	5259.3	4468.5	6414.9	3482.8	3623.1	3478.6	1001.6	3099.0	2975.0	1689.4	4788.8
Average Far East Asia = 3373.18													

Source: Computed from World Development Indicators 2012

Appendix 2: The Global Sectoral Distribution of Total Aid to Production Sectors (Percentage)[34]

Sector	1995-96	1997-99	2000-02	2003-05	2006-08
I PRODUCTION SECTORS	12.3	10.4	8.9	7.2	7.1
I.1.Agriculture,Forestry,Fishing	9.8	7.7	5.9	4.3	4.7
I.1a. Agriculture	8.0	6.3	4.8	3.5	4.0
I.1b. Forestry	1.1	0.8	0.7	0.5	0.5
I.1c. Fishing	0.8	0.5	0.4	0.2	0.2
I. 2. Industry, Mining, Construction	2.2	2.4	2.2	2.2	1.5
I.3.a. Trade policies& Regulations	0.2	0.3	0.7	0.6	0.8
I.3.b.Tourism	0.1	0.1	0.1	0.1	0.1

Source: Extracted from Islam (2012)

Appendix 3: Composition of Aid to Agriculture (Percentage)

Composition	Bilateral		Multilateral		Average
	2000-2003	2005-2008	2000-2003	2005-2008	2000-2008
Agric Policy and Admin	26.3	17.7	29.3	28.8	25.53
Agric Development	15.6	16.1	13.5	6.9	13.03
Agric land Resource	8.7	2.8	2.0	1.6	3.78
Agric water Resource	14.5	17.4	21.3	18.0	17.8
Agric inputs	6.2	2.3	0.2	0.7	2.35
Food crop production	3.9	4.8	9.8	10.1	7.15
Export crop production	1.8	1.2	1.0	6.3	2.58
Livestock	1.8	1.1	4.0	4.2	2.78
Agrarian Reform	1.0	1.5	0.0	0.6	0.78
Agric alternative dev	1.7	9.6	5.5	0.3	4.28
Agric extension	1.4	2.4	0.1	11.1	3.75
Agric education & training	2.6	2.8	3.0	0.1	2.13
Agric research	7.6	14.7	4.5	1.8	7.15
Agric Service	1.3	2.0	1.2	5.6	2.53
Post-Harvest protection and Pest control	0.8	0.6	1.2	0.2	0.7
Agric Financial Service	2.8	1.0	3.1	1.7	2.15
Agric Cooperative	1.2	1.1	0.6	0.6	0.88
Veterinary Service	0.7	0.9	0.9	1.4	0.98

Source: Computed from Islam (2011)

[34] Combined Multilateral and Bilateral Aid

Appendix 4: Sectoral Distribution of Total Agricultural Aid to SSA and Asia (2005-2008)

	Sub-Saharan Africa	South and central Asia	Far East Asia
Agricultural policy and administrative management	29%	15%	17%
Agricultural development	12%	11%	16%
Agricultural land resources	3%	3%	3%
Agricultural water resources	9%	36%	27%
Agricultural inputs	2%	1%	3%
Food crop production	10%	3%	4%
Industrial crops/export crops	4%	1%	1%
Livestock	3%	3%	25
Agrarian reform	1%	0%	6%
Agricultural alternative development	0%	14%	0%
Agricultural extension	8%	7%	5%
Agricultural education/training	2%	0%	1%
Agricultural research	7%	1%	10%
Agricultural services	5%	3%	1%
Plant/post-harvest protection and pest control	1%	0%	0%
Agricultural financial services	2%	2%	1%
Agricultural cooperatives	1%	0%	0%
Livestock/veterinary services	1%	0%	2%

Source: Extracted from Coppard (2009)

Appendix 5: Group Unit Root Test Summary Variables Used in the foreign agricultural aid and Agricultural Productivity Equations

Method	Statistic	Probability**
Null: Unit Root(assumes Common Unit Root Process)		
Levin, Lin &Chu t*	-7.70	0.00
Null: Unit Root(assumes Individual Unit Root Process)		
Im, Pesaran &Shin W-Stat	-18.84	0.00
ADF-Fisher Chi-square	380.07	0.00
PP-Fisher Chi-square	501.19	0.00
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality		

Source: Computed by the Author

Appendix 6: Johansen Cointegration Test of Foreign Aid and Agricultural Productivity

Sample (adjusted) 4 422 Included observation :332 after adjustment Trend Assumption: Linear Deterministic trend				
Unrestricted Cointegration Rank Test(Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Probability****
None*	0.2559	156.29	15.49	0.0001
At most 1*	0.1607	58.18	3.84	0.0000
Trace test indicates 2 cointegrating equations at the 0.05 level * Denotes rejection of the hypothesis at the 0.05 ** Mackinnon- Hang-Michelis (1999) p- values				
Unrestricted Cointegration Rank Test(Maximum Eigenvalue)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Probability****
None*	0.2559	98.11	14.26	0.0000
At most 1*	0.1607	58.18	3.84	0.0000
Max-Eigenvalue test indicates 2 cointegrating equations at the 0.05 level * Denotes rejection of the hypothesis at the 0.05 ** Mackinnon- Hang-Michelis (1999) p- values				

Source: Computed by the Author

Appendix 7: Comparison of Mean Foreign agricultural aid Received in the Landlocked and other Countries in SSA

Countries	**Mean Log Total Agric Aid**	**Mean Log Bilateral Agric Aid**	**Mean Log Multilateral Agric Aid**
Landlocked Countries	2.96	2.31	2.41
SSA Countries	2.51	1.85	1.73
T-test	-2.69*	-2.75*	-3.20*

Source: Computed by the Author * Significant at 5%

Appendix 8: Comparison of Weather Shocks Based on the Regions in Countries in SSA

Regions	**Mean Weather Shock**
Central Africa	1.11
South Africa	0.77
West Africa	0.76
East Africa	0.53
F-Value	15.90*

Source: Computed by the Author * Significant at 5%

Appendix 9: Comparison of Bilateral and Multilateral Foreign agricultural aid in SSA

Countries	**Mean Log Bilateral Agric Aid**	**Mean Log Multilateral Agric Aid**	**Ratio of Agric Bilateral to Total Agric Aid**
SSA Countries	1.85	1.73	55%
T-test	0.90		

Source: Computed by the Author

Appendix 10: Group Unit Root Test Summary of Variables Used in the Foreign Aid and Agriculture GDP Equations

Method	**Statistic**	**Probability****
Null: Unit Root(assumes Common Unit Root Process)		
Levin, Lin &Chu t*	-6.58	0.00
Null: Unit Root(assumes Individual Unit Root Process)		
Im, Pesaran &Shin W-Stat	-17.86	0.00
ADF-Fisher Chi-square	342.04	0.00
PP-Fisher Chi-square	463.35	0.00
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality		

Source: Computed by the Author

Appendix 11: Johansen Cointegration Test of Foreign Aid and Agriculture GDP

Sample (adjusted) 4 422 Included observation :332 after adjustment Trend Assumption: Linear Deterministic trend				
Unrestricted Cointegration Rank Test(Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Probability****
None*	0.0766	41.43	15.49	0.0000
At most 1*	0.0636	18.72	3.84	0.0000
Trace test indicates 2 cointegrating equations at the 0.05 level * Denotes rejection of the hypothesis at the 0.05 ** Mackinnon- Hang-Michelis (1999) p- values				
Unrestricted Cointegration Rank Test(Maximum Eigenvalue)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Probability****
None*	0.0766	22.71	14.26	0.0019
At most 1*	0.0636	18.72	3.84	0.0000
Max-Eigenvalue test indicates 2 cointegrating equations at the 0.05 level * Denotes rejection of the hypothesis at the 0.05 ** Mackinnon- Hang-Michelis (1999) p- values				

Source: Computed by the Author

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