ECONOMIC INSTITUTIONS AND AGRICULTURAL OUTPUT IN SUB- SAHARA AFRICA

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Abstract

This paper examined the impact of two economic institutional variables viz land property rights and market freedom on agricultural output, using a Sub-Saharan African sample. Panel ARDL techniques are employed in the empirical analysis. The findings show that property rights and market freedom have no short-run effect on agricultural output. However, in the long run, land property right is significant, though, with a negative sign, market freedom remains insignificant. The two institutional variables were not statistically significant through the short and long runs in the presidential system. Meanwhile, land property right has a long-run significant positive effect on agriculture output in the parliamentary system. Therefore, it is recommended that land reforms that will guarantee the protection of land property rights for the majority of farmers should be given urgent attention, particularly in countries with the presidential system and across SSA countries in general.

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Introduction

The economies of Sub-Sahara African (SSA) countries are heavily dependent on agriculture, which not only employ more than two-thirds of the labour force but also accounts for about 35 per cent of GNP, 40 per cent of foreign exchange earnings (Shimides et al 2018). It is also the key contributor to wealth creation and poverty alleviation. A large number of people, which stood at about 60 per cent of the population derive their income from agriculture and related activities (McCullough 2017). Thus, a well-performing agricultural sector is fundamental for Africa's overall economic growth, as well as for addressing the problems of hunger, poverty, inequality and other developmental problems. However, over the years the rate of growth in agricultural production has stagnated and failed to keep pace with the needs of a rapidly growing population (McCullough 2017). Hence, resulting in a progressive increase in bills of food imports and industrial raw materials (McCullough 2017; Shimides et al 2018). Therefore, it is imperative to study how the performance of the agricultural sector can be improved particularly in the Sub-Saharan region of Africa continent.

Most existing studies on how to improve the performance of the agricultural sector focused on traditional production inputs. While there are few studies on the impact of some specific institutional variables on agricultural performance in some countries (see, for example, Delville, 2010; Kunz, et al, 2016; Higgins et al 2018; Temesgen, 2018; Fowowe 2020), there is the death of literature on the general impact of economic institutions in SSA. Hence, this paper aims at empirically investigating the impact of economic institutions on the performance of the agricultural sector in SSA. Specifically, the paper examines the impacts of land property rights and market freedom on agricultural output. The paper further investigates whether the influence of these economic institutions on the agriculture sector varies across the different political systems in SSA countries.

Land property right has a bearing on agricultural output in two ways, first, land property right creates an incentive for productive and effective use of land. Second, land property right facilitates access to credit

which enable farmers to purchase more inputs. The argument is that secure property right on land is an asset that farmers can use to access loans from financial institutions. As pointed out by Iwayemi and Kilishi (2016), the secure land property right to the majority of farmers in a country is sine-qua-non to creating inclusive opportunities for better and modern mechanised farming practices. Hence, securing land property for the mass of the people is key to enhancing the performance of the agricultural sector. Thus, this study contributes to the literature on determinants of agricultural output in Africa by exploring the dynamic short and long-run effects of land property rights using the Sub-Saharan Africa sample. Most studies that attempt to explain the performance of agriculture in Africa focus on traditional determinants such as the basic agriculture inputs, input subsidies, access to credit among others while ignoring the effect of property rights. The few existing studies on the impact of property rights are country-specific which does not allow examining the cross-sectional and time dynamics.

The rest of the paper is arranged in 4 sections. The literature review is in section 2, empirical model, nature and conceptual framework, sources of data, as well as estimation procedure, are presented in section 3, the results are discussed in section 4 and section 5 concludes the paper.

Literature review

Several studies have explained the determinants of agricultural output in both developed and developing economies. It is established that analyzing determinants of agricultural output does not generally follow a unified rigorous model (Odhiambo et al 2004; Ahmad & Heng 2012; Macanu et al 2018; Ma et al 2021). Therefore, most of the studies argued that land, labour, capital, climate, fertilizer and machinery, that is, the traditional inputs are the main determinants of agricultural output (Paul & Bidemi 2018; Singh 2019).

Polycarp and Jirgi (2011), Eing and Nhor (2019), Rajni and Nimai (2021) on the other hand, showed that beyond the traditional inputs, institutional and environmental variables play important role in determining agricultural output, particularly in developing countries. Reynolds et al. (2015), Chari et al (2021) argued that factors constraining agricultural development in Africa include land property rights, poor access to market and credit, land degradation, lack of market freedom, high input prices and low product prices. Furthermore, Gray and Weseen (2008), Headey et al (2010) also identified public policies as a key factor that influences the performance of the agricultural sector. Amrouk et al. (2013) equally found a positive relationship between access to market and agriculture output.

In addition to this, some studies on African settings have formally tested the nature and the strength of the relationship between tenure security and agricultural output changes. For example, Kunz, et al, (2016) did a study in the Gambia; Higgins et al (2018) in Ghana, Kenya and Rwanda, while Delville, (2010) did a study in Kenya. These studies found that the presence of land titles did not affect agricultural output in any significant way. These results are contrary to the widely-held notion that security of tenure and titling leads to higher output. Meanwhile, studies that used the SSA sample found that land tenure has greatly contributed to agricultural output due to recent land reform applied by several governments (Lund and Rachman, 2016; Li and Zhang, 2017; Lawry et al, 2017). However, land tenure was negatively correlated to agricultural output in countries such as Uganda, DR Congo, because the neoliberal policies emphasizing market-based lands reforms put pressure on customary tenure thus creating more insecurity for poor farmers.

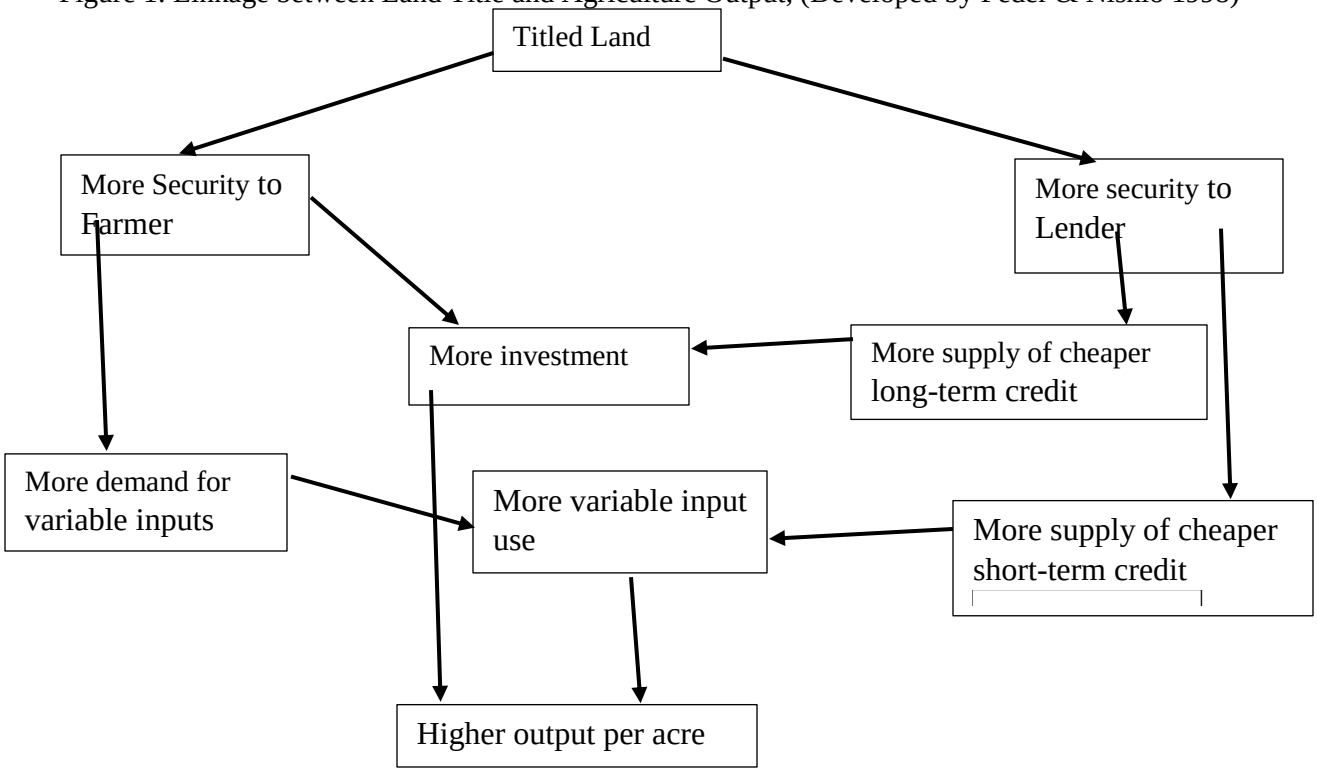
Some studies equally identified the lack of access to credit facilities as a major constraint to agricultural development in Africa (Abayomi & Salami 2008; Oyelade 2019; Osabohien et al 2020; Sekyi et al 2020; Florence & Nathan 2020). Mhlanga (2010) clearly stated that access to credit is necessary for the purchase of farm inputs such as improved seed varieties, breeds of livestock, fertilizers, insecticides, pesticides, modern implements, among others. He stressed the suitability of terms of credit as a necessary condition for fostering agricultural development. Salami et al (2010) averred that credit is a major factor necessary for technological transfer in traditional agriculture.

Another set of studies investigated the impact of farm input subsidies in sub-Saharan Africa (SSA) (Walls et al 2018; Stein 2019). Ricker-Gilbert and Jayne (2011) and Mason et al. (2013) analyzed the effects of subsidized fertilizer on maize production in Malawi and Zambia respectively. They find that an additional kg of subsidized fertilizer increases maize production by1.82 kg and 1.88 kg, respectively. Analyzing maize output response, (Chibwana et al. 2012; Dorward et al. 2013) also find positive effects of farm input subsidies in Malawi. All these studies suggest improved food availability due to the use of farm input subsidies and this is supported by studies on household welfare. Dorward & Chirwa, 2011; Chirwa et al., 2013; Dorward et al., 2013; Arndt et al 2015 show that availability of farm input subsidies results in improvement inadequacy of food availability at the household level.

Conceptual framework

The conceptual framework in this paper follows from the framework developed by Feder and Nishio (1998). The framework was first developed by Feder et al (1988) in the context of land titling in rural Thailand. Based on the framework, there are two sources of linkages between land property rights with the performance of agriculture. The first is that property rights create incentives to invest and use the land effectively. The second, property right plays a role in collateral arrangement, hence facilitating access to institutional credit. Secure property right on land would minimise the uncertainty on whether or not landowners can reap the benefits of long-term investment. Thus, there is an incentive for the landowner to carry out a significant complementary investment on the land which is critical to the productivity of the land. On the other hand, secure land property right helps in resolving asymmetric information problems such as the incentive problem of moral hazard and adverse selection. When the land title is used as collateral, the borrower will make effort to repay the loan so as not to lose the land to the creditor, hence, solving the moral hazard problem. The creditor, on the other hand, can also use land titles to easily identify potential defaulters and then screen them out, hence the adverse selection problem is solved. In summary, with secured land property rights, farmers would have an incentive to invest in their land and also be able to access institutional credit facilities. With more access to credit, they can purchase more agriculture inputs, hence, leading to more output.

Figure 1: Linkage between Land Title and Agriculture Output, (Developed by Feder & Nishio 1998)



The empirical model

The empirical model consists of three vectors of predictors, viz traditional factors; institutional factors; and control variables. The traditional factors included are land, labour, capital and whether condition. On the other hand, the institutional variables considered are land property rights and market freedom. While the amount of fertilizer used, access to subsidy on agriculture inputs and market access are included as control variables. Thus, the empirical model is specified as:

$$AO_{it} = \alpha_i + \sum_{k=1}^{4} \beta_k TF_{it} + \sum_{k=1}^{2} \gamma_k IF_{it} + \sum_{k=1}^{3} \delta_k CV_{it} + \varepsilon_{it} \quad (1)$$

Where AO is real agricultural output, TF is the vector of traditional factors, IF is the vector of institutional factors, CV is the vector of control variables, α_i is a country-specific intercept, ε_{it} is the Gauss – Markov error term, i represents an individual country, and t stands for time. While i is from 1 to 43 (that is, $N = 43$), t ranges from 1990 to 2018 ($T = 28$).

Therefore, the estimable model is specified as:

$$AO_{it} = \alpha_i + \beta_1 Land_{it} + \beta_2 Labour_{it} + \beta_3 Capital_{it} + \beta_4 Temperature_{it} + \gamma_1 LPropertyR_{it} + \gamma_2 MarketFr_{it} + \delta_1 Fertilizer_{it} + \delta_2 ASubsidy_{it} + \delta_3 MarketA_{it} + \varepsilon_{it} \quad (2)$$

Nature and sources of data

Agricultural output is expressed as the monetary value of net production in millions of US dollars. The land is the total available arable land in thousand hectares, while labour is the number of persons actively engaged in agricultural activities. Capital is the amount of money invested in agriculture by a country in US dollars, Fertilizer is the total quantity of fertilizer used in metric tons. Temperature is measured as the average annual change in temperature. Agriculture subsidy is the number of subsidies paid on agricultural inputs. All the aforementioned variables are sourced from FAOSTAT (2018).

Market access (MarketA) is an index that measures the ability of citizens of a country to sell their goods and services across borders. Land property right (LPropertyR) is an index measuring the right of land usage in a country. This right determines who can use land, for how long and under what conditions. It is expected that agriculture output would increase with improvement in this right. Market Freedom (MarketFr) is also an index measuring how the market is free from the intervention of the authority or government. Thus, a higher value of the index indicates a more free-market system. The data for these three variables are sourced from the Heritage Foundation Economic Freedom database.

Estimation technique

Descriptive statistics for all the variables were first carried out. The study conducts a stationarity test of each variable using Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS) test statistics. Two alternative non-stationary heterogenous panel regression techniques are considered in the study. These are Pool Mean Group (PMG) and Dynamic Fixed Effects (DFE). These two techniques are consistent when both T and N are large (Pesaran & Smith, 1995; Pesaran et al 1997; 1999). PMG imposes the assumption of short-run heterogenous slope coefficients and long-run homogenous slope coefficients, while DFE imposes the homogenous slope coefficients but allows constant intercepts to vary across countries. The most efficient of the alternatives is however determined using the familiar Hausman specification test.

Descriptive statistics

The descriptive statistics are presented in Table 1. From the statistics, the average net value of agriculture products in SSA for the period covered was $2503891 million, with a minimum and maximum of $34.447 million and $39 million respectively. On average, countries in the Sub-Sahara region use 48690.2 tones of fertilizer, with a maximum of 477072 and a minimum of 0.07 tones. On average about $2713.23 million is invested in the agriculture sector, with minimum and maximum values of $6.06 million and $64171.71 million respectively. On average, the countries in the region had 57.06 per cent of the entire population engaged in the agricultural sector, with a maximum of 92.56 per cent and a minimum of 4.6 per cent. The

average available hectare of arable land for agricultural activities in the SSA region is 3870987 hectares of land with a minimum and maximum of 140 and 37000000 hectares respectively. On average 0.78 per cent, change is experienced in temperature across the region, with a minimum of -0.49 per cent and a maximum of 2.45 per cent change. About $448.8 million is paid on average as subsidy on agriculture inputs with a minimum and maximum of $ 0.018 million and $ 32608.65 million respectively. The average index of access to the market in SSA is 56.93 points on a 1 to 100 point scale, while the minimum and maximum are 19 and 91.4 points. The average property right rate for the period covered was 38.05 points with a minimum and maximum of 10 and 78 points respectively. The average market freedom in the region is 54.38 points with a minimum of 23.4 points and 85 points. However, the standard deviation of all the variables shows that the differences across countries in the sub-region are wide.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Agricultural Output	1,161	2503891	4669365	34.44702	3.90E+07
Fertilizer	1,161	48690.2	85354.11	0.07	477072
Tractor	1,161	23390.39	41705.45	0	231519
Capital	1,161	2713.23	6127.581	6.06	64171.71
Labour	1,161	57.06013	19.93534	4.6	92.557
Land	1,161	3870987	5853644	140	3.70E+07
Temperature	1,161	0.776184	0.420832	-0.494	2.45
Agriculture Subsidy	1,161	448.7984	2565.989	0.01821	32608.65
Market Access	1,161	56.92911	11.09486	19	91.4
Land Property Right	1,161	38.04537	13.0557	10	78
Market Freedom	1,161	54.38222	10.80426	23.4	85

Source: computed by authors

Report on unit root tests

Table 2 presents the unit root test results obtained using Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS) testing procedures. The tests were carried out at a 5 per cent significance level. LLC results show that Agricultural output, fertilizer, tractor, capital, land, temperature, and subsidy are stationary at level, implying that they are integrated of order zero I(0). On the other hand, the remaining variables became stationary after the first difference, hence, they are integrated of order one I(1). It is, therefore, ascertain that no variable is integrated of order 2. The combination of I(0) and I(1) variables suggests the use of the long-run panel cointegration approach in addition to the fact that T and N are both large. The study employs a non-stationary heterogenous panel regression technique (also called the long-run panel cointegration technique) due to the relatively large T and N that characterized the data of the study. Long run panel cointegration approach is an extension of the times series model to the panel model with large T. There are three alternative techniques for the long run panel cointegration namely; Mean Group (MG henceforth), Pool Mean Group (PMG henceforth) and Dynamic Fixed Effects (DFE henceforth). However, only PMG and DFE are considered in this study. Though the two techniques are based on different assumptions, they both employ Autoregressive Distributed Lag (ARDL) framework. The most efficient of the two alternatives is determined using the familiar Hausman specification test.

Table 2: The Result of Unit Root Test

Variable	LLC at Level (t-Stat)	LLC at 1st Diff (t-Stat)	IPS at Level (t-Stat)	IPS at 1st Diff (t-Stat)
Agricultural Output	-2.0265**		2.9290	-20.0755***
Fertilizer	-42.0133***		-45.6986***	
Tractor	-23.4076***		-32.0073***	
Capital	-48.7136***		-43.1637***	
Labour	-0.4625	-6.1038***	3.0597	-7.7520***
Land	-2.6595**		1.2986	-12.6442***
Temperature	-3.8853***		-2.9839***	
Agriculture Subsidy	-44.6486***		-51.8217***	
Market Access	-0.1998	-14.1986***	4.0806	-20.0165***
Land Property Right	1.1464	-9.5858***	2.5311	-6.6990***
Market Freedom	0.3898	-15.7023***	2.5849	-25.5769***

Source: Computed by authors, ** Significant 5%, ***Significant at 1%

Regression results

Based on the outcome of the Hausman test, the Pool Mean Group (PMG) is more efficient. Therefore, only the PMG results are reported. Table 3 presents the baseline model result in model 1, while land property rights are introduced in model 2 and market freedom is controlled for in model 3. The coefficient of ECT (Error Correction Term) in the three models is negative and statistically significant which indicates the existence of a long-run relationship in the models.

In the short run, all the variables are not statistically significant in the three models except temperature which is significant and negative in models 1 and 3. This implies that in the short-run, economic institutions and even the traditional variables do not influence agricultural output except temperature changes. This finding raises concern on the effect of climate change on food availability in Sub-Sahara African countries. Since temperature is changing radically across the globe due to climate change, appropriate measures need to be taken in SSA to avert too much decline of agriculture products.

However, in the long run, the coefficients of fertilizer are significant and positive in the three models. It is indicative from the coefficients that with a 1 per cent increase in fertilizer usage, the output of agriculture would rise by 0.018 per cent. The output increases by 0.0064 per cent when property rights were controlled, while it rises by 0.018 per cent when market freedom is introduced. It seems that property right reduces the effect of fertilizer, while the presence of market freedom does not make any difference in the effect of fertilizer. The implication is that poor protection of land property would not allow farmers to maximize the benefit of using fertilizer in SSA. Capital investment is statistically significant in the three models but the sign-in model 2 is contrary to expectation. Meanwhile, sign-in models 1 and 3 indicates that more capital investment in agriculture would lead to more output in SSA. On the other hand, the negative sign in model 2 might be because of poor protection of land property rights in the SSA sub-region. Thus, an increase in capital investment might hurt agricultural performance if property right on land is not widely and strongly protected.

The coefficients of labour employed in the agricultural sector are significant and negative in the three models, implying that engaging more labour in agriculture would result in a reduction in output. This finding could be a reflection of decreasing marginal product of labour when more labour is added without a corresponding increase in landholding particularly by smallholder farmers. Land depicts significant and positive coefficients in models 1 and 3, while it is negative and significant in model 2. The evidence from models 1 and 3 is that one percentage addition of land would induce about a 2.7 per cent increase in agricultural output. While the counterintuitive evidence in model 2 may be due to poor protection of land property rights. Temperature shows a significant sign in models 1 and 2, though, it is positive in

model 1 but negative in model 2. The positive sign might be due to various precautionary measures taken by farmers to mitigate the effect of climate change.

Subsidy on agriculture inputs has positive and significant coefficients in models 1 and 3, but not statistically significant in model 2. The evidence from models 1 and 3 is that more subsidies on agriculture inputs would lead to more agriculture output. Subsidy becoming insignificant when property rights are introduced indicates that subsidy without the protection of land property rights may not influence the output. Market access shows negative and significant coefficients in models 1 and 3, while it is significant and positive in model 2. The sign in models 1 and 3 is not consistent with the evidence in the literature. The counterintuitive findings evident in models 1 and 3 might be due to restricted access to the local and international market by the majority of farmers in SSA. However, market access shows a consistent positive sign in model 2 where land property right is controlled for.

The two economic institutional variables considered are not statistically significant in the short run. This is not completely surprising because institutional reforms do not usually have instantaneous effects. Meanwhile, in the long run, coefficients of land property rights are statistically significant, while market freedom remains insignificant. However, the sign of land property rights is negative which contradicts a-priori expectation. This finding might be due to poor protection of land property rights observed across SSA countries.

The model is further evaluated using a sample based on a system of government viz Presidential and Parliamentary system. The results obtained from PMG estimates are presented in Table 4. In Table 4, models 4 and 5 are obtained from a sample of countries operating the presidential system, while models 6 and 7 are obtained from the parliamentary system. The coefficients of ECT in all the results are statistically significant with correct signs (negative). As the results in Table 3, all the variables in the short-run are not statistically significant except temperature and subsidy that are significant only in the presidential system. The two significant variables in the short-run show negative signs. The negative coefficient of temperature is consistent with the initial finding. However, the negative sign of subsidy is not expected, though this might be due to misappropriation of the subsidy funds as many studies have shown that corruption is more prominent in the presidential system than parliamentary system (for the link between regime type and corruption see Panizza, 2001; Gerring &Thacker, 2004; Lederman et al., 2005; Kunicov´a & Rose-Ackerman, 2005).

However, in the long-run results, the coefficients of fertilizer, capital, land, temperature and subsidy are positive and statistically significant in the presidential sample, while labour and market access are negative and significant. Meanwhile, land property rights and market freedom are not statistically significant. Comparably, in the parliamentary system, fertilizer, capital, land, subsidy and land property rights show positive and significant signs, while labour and market access are negative and statistically significant. Temperature and market freedom are not statistically significant. Though, fertilizer is significant when market freedom is controlled for, while capital and labour are significant in the model with land property rights. The long-run coefficient of land property rights is statistically significant in the parliamentary sample.

As a robustness check, the sample is sub-divided into sub-regions comprising of Central, East, South and West African countries respectively. The results are presented in Appendix. The short-run results are similar to the findings in the full sample. The two institutional variables are not statistically significant in the short run. In the long run, land property right has a significant positive coefficient in the East African sample, and a significant negative coefficient in the West African sample, while it is not significant in the Central and South African samples. Market freedom is not significant except in the East African sample where it is significant at 10 per cent with a negative sign.

Table 3: Pooled Mean Regression Estimator Result, Dependent variable is

Variable	Model 1	Model 2	Model 3
Short-run			
ECT	-0.341*** (0.0528)	-0.324*** (0.0551)	-0.353*** (0.0526)
D.Fertilizer	-70.44 (154.9)	75.14 (169.2)	14.81 (109.5)
D.Capital	-0.877 (1.151)	-2.622 (1.789)	-1.030 (1.092)
D.Labour	467.6 (467.6)	434.3 (434.3)	350.6 (350.6)
D.Land	1.809 (2.851)	3.917 (3.426)	2.725 (3.283)
D.Temperature	-0.0181** (0.00856)	-0.0114 (0.00835)	-0.0218* (0.0119)
D.ASubsidy	-19.45 (14.20)	-29.23 (22.53)	-20.20 (12.96)
D.MarketA	-410.6 (414.3)	-358.3 (396.4)	-487.0 (505.4)
D.LPropertyR		411.1 (378.3)	
D.MarketFr			12.23 (20.24)
Constant	-643.5 (514.9)	-317.8 (567.9)	-561.2 (405.9)
Long-run			
Fertilizer	0.0187*** (0.00608)	0.0064*** (0.00109)	0.0184***(0.00472)
Capital	0.0385*** (0.00640)	-0.0293*** (0.0046)	0.0342*** (0.00604)
Labour	-0.0143*** (0.0014)	-0.0121*** (0.0014)	-0.0154*** (0.0014)
Land	2.690*** (0.119)	-0.205** (0.103)	2.621*** (0.116)
Temperature	0.0365** (0.0169)	-0.0180** (0.00901)	0.0259 (0.0168)
ASubsidy	0.0735*** (0.0085)	2.47e-05 (0.0139)	0.0764*** (0.00873)
MarketA	-0.0021*** (0.0007)	0.0029*** (0.00076)	-0.0022*** (0.0006)
LPropertyR		-0.0025*** (0.0005)	
MarketFr			0.0009 (0.00078)
Hausman Test	1.0000	1.0000	1.0000
Observations	1,118	1,118	1,118

Source: computed by authors, Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4: Regression Estimation Results by System of Government

Variable	Presidential		Parliamentary	
Short-run	Model 4	Model 5	Model 6	Model 7
ECT	-0.334*** (0.0582)	-0.350*** (0.0589)	-0.630*** 0.161)	-0.584***(0.150)
D.Fertilizer	43.67 (110.9)	67.92 (107.8)	-1.026 (1.017)	-497.1 (483.4)
D.Capital	-0.852 (1.239)	-0.905 (1.127)	-0.00450(0.0714)	-0.0259(0.0523)
D.Labour	537.6 (537.6)	396.0 (395.9)	-0.00205(0.0143)	-0.0181**(0.009)
D.Land	3.302 (3.744)	3.089 (3.726)	1.523 (3.565)	-1.225 (2.077)
D.Temperature	-0.0178* (0.00987)	-0.0232* (0.0134)	-0.00730(0.0217)	-0.0167 (0.0193)
D. ASubsidy	-34.25* (17.96)	-23.68** (11.96)	41.23 (77.00)	42.05 (103.1)
D.MarketA	-446.8 (469.4)	-568.1 (575.7)	-103.5 (65.15)	-36.58 (24.20)
D.LPropertyR	395.4 (375.7)		59.69 (41.85)	
D.MarketFr		12.46 (22.29)		10.59 (10.58)
Constant	-451.0 (667.4)	-629.6 (458.5)	-69.53 (52.88)	-14.40 (17.61)
Long-run				
Fertilizer	0.0179***(0.0064)	0.0190***(0.0052)	-0.0662 (0.0949)	0.138* (0.0704)
Capital	0.0364***(0.0075)	0.0373***(0.0062)	0.0321*(0.0164)	0.0200 (0.0257)
Labour	-0.0148***(0.002)	-0.0157***(0.002)	-0.019***(0.006)	-0.0064(0.0078)
Land	2.734*** (0.138)	2.746*** (0.121)	2.197*** (0.363)	1.218*** (0.281)
Temperature	0.0418** (0.0171)	0.0407** (0.0182)	-0.0123 (0.0224)	-0.00571(0.0243)
ASubsidy	0.0740***(0.0102)	0.0722***(0.0096)	0.0149*(0.0082)	0.0168**(0.008)
MarketA	-0.002***(0.0007)	-0.003*** (0.0006)	-0.022***(0.007)	-0.033***(0.008)
LPropertyR	9.72e-05(0.0007)		0.028***(0.006)	
MarketFr		0.0011 (0.0008)		0.0006 (0.0016)
Hausman Test	1.0000	1.0000	1.0000	1.0000
Observations	988	988	130	130

Source: computed by authors, Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Concluding remarks

The paper examined the impact of land property rights, market freedom and traditional agriculture input variables on agricultural output, using a Sub-Saharan African sample. Panel ARDL techniques are employed in the empirical analysis. The findings show that there is no short-run effect of property rights and market freedom on agricultural output. Even the traditional variables do not have a significant impact on agriculture output in the short–run. However, in the long-run, land property rights is significant, though, with a negative sign, market freedom remains insignificant. In the presidential system, the two-institutional variable considered (land property rights and market freedom) are not statistically significant both in the

short and long runs respectively. On the other hand, land property right has a long-run significant positive effect on agriculture output in the parliamentary system.

The main conclusions from this study are that: land property rights and market freedom do not have an instantaneous short-run effect on agriculture output; market freedom does not matter in predicting agriculture output either in the short-run or long run, and that this outcome is not different between presidential and parliamentary system. It can also be concluded from the findings that poor protection of land property rights negatively influences the effects of fertilizer usage and capital investment, and protection of land property rights promote long-run agriculture output in the parliamentary system, and it does not affect agriculture output in the presidential system.

The policy inference from the findings is that there is a crucial need for land reform in Sub-Saharan Africa which will guarantee the protection of land property rights for the majority of farmers. It is even more urgent in countries with a presidential system of government. This is necessary if only SSA countries would achieve agricultural output growth in the long run.

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Appendix 1: Sub-regional regressions

	CA Countries		EA Countries		SA Countries		WA Countries	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Short-run								
ECT	-0.192	-0.190	-0.175**	-0.143***	-0.491**	-0.480**	-0.404***	-0.426***
	(0.213)	(0.195)	(0.0807)	(0.0542)	(0.244)	(0.209)	(0.108)	(0.0927)
D.lfert	-214.3	-183.3	-105.9	-111.6	-841.4	-462.8	266.1	239.2
	(188.0)	(154.8)	(72.02)	(87.86)	(841.4)	(462.8)	(277.2)	(255.7)
D.ltractor	332.7*	359.5*	173.3	219.8	846.6	466.4	-261.6	-226.3
	(197.4)	(218.2)	(126.5)	(201.7)	(846.6)	(466.4)	(281.1)	(261.0)
D.lcap	-0.0428	-0.0360	0.0554	0.00483	-0.0371	0.00151	-6.256	-4.318
	(0.0676)	(0.0655)	(0.0478)	(0.0272)	(0.127)	(0.0826)	(4.329)	(3.578)
D.labor	0.000904	0.000292	1,139	854.9	-0.0113	-0.0108	0.0895	0.0875
	(0.0100)	(0.0108)	(1,139)	(854.9)	(0.00879)	(0.0104)	(0.0895)	(0.0899)
D.lland	-11.99	-12.00	-1.802	-0.0975	20.66*	17.96	5.154	3.202
	(8.157)	(9.459)	(2.486)	(0.876)	(12.50)	(12.81)	(5.321)	(3.150)
D.temp	-0.00841	-0.0134	-0.00910	-0.0161	-0.0239	-0.0170	-0.0128	-0.0401
	(0.0122)	(0.0135)	(0.0163)	(0.0196)	(0.0283)	(0.0287)	(0.0121)	(0.0269)
D.lcredit	1,152	637.1	26.25	27.21	-25.01	-37.75	-7.636	-8.746
	(1,272)	(730.1)	(21.03)	(37.27)	(24.76)	(37.50)	(7.264)	(6.237)
D.mktacc	-48.57	-46.60	62.52	28.95	148.4	206.2	-962.6	-1,355
	(35.56)	(34.88)	(76.03)	(55.77)	(205.3)	(133.8)	(968.1)	(1,356)
D.propryt	-0.125		1,261		176.0		16.34	
	(51.10)		(1,317)		(108.5)		(28.38)	
D.mktfr		24.45		-13.03		78.86		-9.430
		(33.22)		(49.71)		(78.86)		(40.06)
Constant	-136.9	-71.35	-150.6	-964.5	-76.06**	-75.38***	-325.2	-437.9
	(100.8)	(58.32)	(1,652)	(922.2)	(37.03)	(22.26)	(289.4)	(419.0)
Long Run								
Lfert	-0.00949	0.0531	-0.0256	0.172***	-0.0336	-0.0285	0.00141	0.0186
	(0.0667)	(0.0645)	(0.0332)	(0.0594)	(0.0317)	(0.0361)	(0.0158)	(0.0124)
Ltractor	0.350**	0.230	-0.0352	0.0229	-0.0179	-0.0420*	0.0242***	0.00392
	(0.165)	(0.142)	(0.0415)	(0.0667)	(0.0200)	(0.0223)	(0.00861)	(0.00637)
Lcap	0.533***	0.603***	-0.366***	-0.396***	0.150***	0.132***	-0.00171	0.0411***
	(0.0954)	(0.103)	(0.0692)	(0.0763)	(0.0373)	(0.0341)	(0.0136)	(0.00770)
Labor	0.072***	0.0980***	0.0292*	0.0457***	0.00560	0.00281	-0.014***	-0.015***
	(0.0252)	(0.0243)	(0.0154)	(0.00874)	(0.00387)	(0.00402)	(0.00195)	(0.00171)
Lland	24.80***	22.61***	2.266***	0.571***	4.013	10.71*	0.841***	2.528***
	(3.620)	(3.321)	(0.346)	(0.188)	(5.171)	(5.578)	(0.164)	(0.153)
Temp	0.120***	0.147***	-0.0221	0.206***	0.0175	-0.000349	-0.0166	0.00227
	(0.0313)	(0.0328)	(0.0864)	(0.0594)	(0.0306)	(0.0279)	(0.0207)	(0.0251)
Lcredit	22.55	2.929	0.268***	0.262***	0.0305**	0.0246***	0.215***	0.0650***
	(25.38)	(2.662)	(0.0427)	(0.0319)	(0.0125)	(0.00904)	(0.0323)	(0.0116)
Mktacc	-0.05***	-0.047***	0.00931*	-0.0105**	-0.00152	-0.00952	0.00193**	-0.0016**
	(0.00735)	(0.00748)	(0.00534)	(0.00485)	(0.00835)	(0.0107)	(0.000811)	(0.000706)
Propryt	-0.00317		0.0297***		-0.00157		-0.004***	
	(0.00277)		(0.00557)		(0.00116)		(0.000894)	
Mktfr		0.00129		-0.00791*		0.000955		-0.000731
		(0.00215)		(0.00440)		(0.00180)		(0.00124)
Hausman Test	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Observations	208	208	364	364	130	130	416	416

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1