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NEXUS BETWEEN GOVERNMENT AID AND AGRICULTURAL PRODUCTIVITY: A POTENTIAL POVERTY ALLEVIATION TOOL IN THE GAMBIA POST COVID-19: AN EMPIRICAL ANALYSIS (PART 2: FINDINGS AND DISCUSSION)

Abstract. This study continues the theoretical considerations related to the problem of world poverty and the role that agriculture plays in solving this problem and employed an Error Correction Model (ECM) and OLS technique to analyse the nexus between government aid and productivity empirically. Using a time-series data of 27 years annually, we estimate six different regression models in determining the causal effects of the following explanatory variables; Fertiliser, Pesticide, Land availability for agricultural activities and government aid to farmers on the six dependent variables such as; Vegetables, Paddy Rice, Groundnut, Maize, Millet and Sorghum. The results indicate a positive relationship between government aid in the form of agricultural input and productivity. However, fertiliser has a negative relation with Paddy rice, Groundnuts, Maize, Millet and Sorghum; this could be explained as a result of the inadequate supply of fertilisers by the government to farmers. Thus, productivity is empirically established to be affected by the quality and amount of government aid in the form of agricultural inputs.

Keywords: poverty, COVID-19, agricultural investment, agricultural productivity

FINDINGS AND DISCUSSIONS OF EMPIRICAL ANALYSIS

The agricultural productivity is expected to reduce poverty as featured in the literature, based on the concept that higher productivity will mean availability of food products, a decline in real food prices as a result of an increase in supply as well as more employment opportunities and increase the real income of household farmers.

Hence, there is a need for the empirical analysis to establish with facts the nexus between government aid and agricultural productivity in The Gambia. This empirical analysis will also aid in the recommendation of appropriate policies for a successful implementation. To achieve this, the study employed six different regression models based on the major cash crops of the country under investigation to determine the causal effect between the explanatory variables (Agricultural Inputs/government aid) and the dependent variables (Agricultural

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productivity). The results are presented in dual models; logged dependent variables (model 1) expressed in percentage terms, and all the variables at level (model 2) measuring in unit change. The results of the empirical estimates for each model are discussed:

Equation 1 [VEGETABLES]
This equation explains the relationship between the independent variables and Vegetables.

$$\text{Vegetables} = \beta_0 + \beta_1\text{Fert} + \beta_2\text{Pest} + \beta_3\text{av} - \text{land} + \beta_4\text{PGovaid} + u$$

In model 1, a log level model is estimated; thus, estimated parameters can be termed as a percentage effect on the dependent variable. The relationship between Vegetable productivity, and pesticides [Pest], fertilisers [Fert] and the Constant are all statistically significant at 1%. Implies that they all affect vegetable productivity while other independent variables have been accounted for. However, while [Pest] and [Fert] are significant at 1%, agricultural land use [av-land] and Policy for Government aid to the farmers [PGovaid] are not statistically significant. Given the regression results in Model 1, a percentage increase in [Pest] and [Fert] will result in vegetable productivity to increase by 0.0127% and 0.00257% respectively. In Model 2, for every one-tonne increase in pesticides and fertilisers, it will result in an increase in vegetable productivity by 1.151 and 0.283 tonnes respectively while holding all other variables constant.

The results also indicate that agricultural land use [av-land] and [PGovaid] are not statistically significant. However, the explanation for the former could be because the majority of women farmers involved in vegetable production usually cultivate in their backyards or small empty plots around their neighbourhood, so land used is not a significant factor impeding their vegetable growing activity. Government policy on aid, although not statistically significant, measures the difference between periods in which farmers received pesticides [Pest] and fertilisers [Fert] aid from the government against periods they did not receive any assistance. We can see a difference of about 3.5% and 245.7 tonnes in model 1 and 2 respectively in favour of government aid.

Equation 2 [RICE PADDY]
This equation explains the relationship between the independent variables and Rice Paddy productivity.

Table 1. Regression Results of the Independent Variables and Vegetable Production

VARIABLES	(1) Model 1	(2) Model 2
[av-land]	0.000660	7.522
	(0.000504)	(4.572)
[Pest]	0.000127***	1.151***
	(4.50e-05)	(0.408)
[Fert]	2.57e-05***	0.283***
	(4.72e-06)	(0.0428)
[PGovaid]	0.0354	245.7
	(0.0386)	(349.9)
Constant	8.632***	3,869
	(0.280)	(2,537)
Observations	28	28
R-squared	0.868	0.897

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

Table 2. Regression Results of the Independent Variables and Rice Paddy Production

VARIABLES	(1) Model 1	(2) Model 2
[Irr-land]	0.417***	19,072***
	(0.0867)	(2,982)
Pesticides [Pest]	8.16e-05	1.925
	(0.000183)	(6.309)
Fertilisers [Fert]	–4.63e-05	–2.828***
	(2.82e-05)	(0.969)
PGovaid	0.342*	11,756*
	(0.180)	(6,198)
Constant	9.006***	–17,036**
	(0.201)	(6,911)
Observations	28	28
R-squared	0.725	0.769

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

$$\text{Rice Paddy} = \beta_0 + \beta_1\text{Fert} + \beta_2\text{Pest} + \beta_3\text{Irr} - \text{land} + \beta_4\text{PGovaid} + u$$

In model one, the dependent variable is logged; hence we are estimating the relationship in terms of percentage effects, while in model 2 all the variables are in level forms, thus measuring a unit change. The variables agricultural land equipped for irrigation [Irr-land], Policy for Government aid to farmers [PGovaid] are statistically significant at 1%, and 10% respectively. Implying that they all affect paddy rice productivity while other independent variables have been accounted for. However, while the [Irr-land] and [PGovaid] have a positive relationship with paddy rice productivity, fertilisers [Fert] have a negative relationship with productivity and pesticides [Pest], is not statistically significant.

One possible explanation for the insignificance of fertilisers and pesticides could be that in general, the amount of fertilisers and pesticides aid the farmers receive is not enough to boost the productivity and yield of their produce.

Given the regression results in model 1, a one per cent increase in the use of [Irr-land] will result in an increase in rice productivity by 41.7% and model 2 for every one-hectare increase in [Irr-land], it will result in an increase in rice productivity by 19,072 tonnes. The [PGovaid], although statistically significant at 10%, measures the difference in rice productivity for periods in which farmers that received pesticides and fertilisers aid from the government to periods in which they did not receive any aid, thus, we can see a difference of about 34.2% and 11,756 tonnes in columns 1 and 2 respectively in favour of government aid to farmers.

Equation 3 [GROUNDNUTS]

This equation explains the relationship between the independent variables and Groundnuts productivity.

$$\text{Groundnuts} = \beta_0 + \beta_1\text{Fert} + \beta_2\text{Pest} + \beta_3\text{av} - \text{land} + \beta_4\text{PGovaid} + u$$

In Model 1, Groundnuts is stationary at a level while all the explanatory variables are stationary at first difference [D]. Hence this model does not employ Error Correction Model [ECM] but rather an Ordinary Least Squares [OLS] regression model. The dependent variable is logged. Thus, the relationship between the variables is a measure of the percentage change. The variables agricultural land use (D[av-land]), Pesticides (D[Pest]) and Policy for Government aid to the farmers [PGovaid] and the Constant are statistically significant at 10%, 10%, 10% and 1% respectively. Implying that they all affect groundnuts productivity while other independent variables have been accounted for. However, while the D[av-land], D[Pest] and [PGovaid] have a positive relationship with groundnuts productivity, D[Fert] have a negative relationship with productivity.

Table 3. Regression Results of the Independent Variables and Groundnuts Production

VARIABLES	(1) Model 1	(2) Model 2
D[av-land]	0.00484*	416.5
	(0.00280)	(266.7)
D[Pest]	0.000245*	22.47
	(0.000139)	(13.25)
D[Fert]	–2.66e-05	–2.879
	(5.70e-05)	(5.426)
PGovaid	0.256*	21,820
	(0.137)	(13,050)
Constant	11.27***	82,719***
	(0.102)	(9,752)
Observations	27	27
R-squared	0.307	0.267

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

Given the regression results in Model 1, a percentage increase in [av-land], [Pest] and [PGovaid] will increase groundnuts productivity by 0.484%, 0.0245% and 25.6% respectively and in column 2 for every one-hectare increase in agricultural land use [av-land] will result in groundnuts productivity to increase by 416.5 tonnes, while pesticides and [PGovaid] increase productivity by 22.47 tonnes and 21,820 tonnes respectively. The results also indicate that fertilisers have a negative relationship with productivity. This can be explained based on the fact that the government does provide some fertilisers, but this has not been enough for all the farmers over the years.

Groundnuts farmers use and require a lot of lands, but they are mostly constrained to growing their groundnuts on the same land every farming season.

This reduces the fertility of the land. Such land requires equal application of fertiliser to maintain its fertility, which is in inadequate supply. This could lead to a negative relationship between groundnuts productivity and fertiliser.

Equation 4 [MAIZE]

This equation explains the relationship between the independent variables and Maize productivity.

$$\text{Maize} = \beta_0 + \beta_1\text{Fert} + \beta_2\text{Pest} + \beta_3\text{land use} - \text{CerealP} + \beta_4\text{PGovaid} + u$$

Note: The variable land use for cereal production [land use-CerealP] is used here instead of available land for agriculture [av-land] because this variable [land use-CerealP] is more representative of the production of maize as it is a cereal crop.

Model 1 and log level model is estimated in which the dependent variable is logged while in model 2; all variables are in level form. Based on the model 1, the relationship between the variables, land use for cereal production [land use-CerealP], pesticides [Pest] and the Constant are statistically significant at 1%, 10%, and 1% respectively. Implying that they all affect maize productivity while other independent variables have been accounted for. However, while the [land use-CerealP] and [PGovaid] have a positive relationship with maize productivity, pesticides [Pest] and fertilisers [Fert] have a negative relationship with productivity.

Given the regression results in model 1, a percentage increase in [land use-CerealP], and [PGovaid] will result in productivity to increase by 0.000626%, and 24.8% respectively and in model 2 for every one-hectare increase in [land use-CerealP] will result in productivity to increase by 0.218 tonnes, while [PGovaid] increase productivity by 2,731 tonnes respectively. The results also indicate that the [Pest] and [Fert] have a negative relationship with productivity, this can be explained base on the fact that the government does provide some pesticides and fertilisers, but this has not been enough for all the farmers over the years.

Equation 5 [MILLET]

This equation explains the relationship between the independent variables and Millet productivity.

$$\text{Millet} = \beta_0 + \beta_1\text{Fert} + \beta_2\text{Pest} + \beta_3\text{land use} - \text{CerealP} + \beta_4\text{PGovaid} + u$$

Table 4. Regression Results of the Independent Variables and Maize Production

VARIABLES	(1) Model 1	(2) Model 2
[land use-CerealP]	6.26e-06***	0.218***
	(1.08e-06)	(0.0239)
[Pest]	–9.49e-05	–6.316*
	(0.000147)	(3.269)
[Fert]	–1.94e-05	–0.967***
	(1.45e-05)	(0.322)
[PGovaid]	0.248*	2,731
	(0.133)	(2,954)
Constant	8.959***	–5,453*
	(0.136)	(3,018)
Observations	28	28
R-squared	0.799	0.862

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

Table 5. Regression Results of the Independent Variables and Millet Production

VARIABLES	(1) Model 1	(2) Model 2
[land use-CerealP]	4.89e-06***	0.462***
	(7.20e-07)	(0.0566)
[Pest]	0.000185*	14.22*
	(9.86e-05)	(7.746)
[Fert]	–3.59e-05***	–3.928***
	(9.72e-06)	(0.764)
[PGovaid]	0.0467	5,173
	(0.0891)	(7,001)
Constant	10.57***	19,425**
	(0.0910)	(7,153)
Observations	28	28
R-squared	0.829	0.862

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

Note: The variable land use for cereal production [land use-CerealP] is used here instead of available land for agriculture [av-land] because this variable [land use-CerealP] is more representative of the production of millet, as it is a cereal crop.

Model 1 is estimated using the log of the dependent variable; the model thus estimates the percentage effect of the explanatory variables on the dependent variable. The relationship between the Millet productivity and [land use-CerealP], [Pest], [Fert] and the Constant are statistically significant at 1%, 10%, 1% and 1% respectively. Implying that they all affect millet productivity while other independent variables have been accounted for. However, while the [land use-CerealP] and [Pest] have a positive relationship with millet productivity, [Fert] have a negative relationship with productivity.

Given the regression results in model 1, a percentage increase in land use for cereal production [land use-CerealP], and pesticides [Pest] will result in productivity to increase by 0.000489%, and 0.0185% respectively and in model 2 for every one-hectare increase in [land use-CerealP] will result in productivity to increase by 0.462 tonnes, while [Pest] increase productivity by 14.22 tonnes respectively. The results also indicate that fertilisers [Fert] have a negative relationship with productivity, this can be explained base on the fact that the government do provide some fertilisers, but this has not been enough for all the farmers over the years.

Equation 6 [SORGHUM]

This equation explains the relationship between the independent variables and Sorghum productivity.

$$\text{Sorghum} = \beta_0 + \beta_1\text{Fert} + \beta_2\text{Pest} + \beta_3\text{land use} - \text{CerealP} + \beta_4\text{PGovaid} + u$$

Note: The variable land use for cereal production [land use-CerealP] is used here instead of available land for agriculture [av-land] because this variable [land use-CerealP] is more representative for the production of Sorghum; hence it is a cereal crop.

For model 1, the dependent variable sorghum is logged, thus capturing the percentage change effect of the independent variables. The relationship between sorghum productivity and land use for cereal production [land use-CerealP] and the Constant is statistically significant at 1%, and 1% respectively. Implying that they all affect Sorghum productivity while other independent variables have been accounted for. However,

Table 6. Regression Results of the Independent Variables and Sorghum Production

VARIABLES	(1) Model 1	(2) Model 2
[land use-CerealP]	5.15e-06***	0.108***
	(1.19e-06)	(0.0228)
[Pest]	0.000201	3.546
	(0.000163)	(3.125)
[Fert]	–1.58e-05	–0.415
	(1.60e-05)	(0.308)
[PGovaid]	0.0662	–13.81
	(0.147)	(2,824)
Constant	8.921***	3,116
	(0.150)	(2,886)
Observations	28	28
R-squared	0.730	0.726

Standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

while all the other variables have a positive relationship with Sorghum productivity, fertilisers have a negative relationship with productivity.

Given the regression results in model 1, a percentage increase in [land use-CerealP] will result in productivity to increase by 0.000515% and in model 2 for every one-hectare increase in [land use-CerealP] will result in productivity to increase by 0.108 tonnes. The results also indicate that fertiliser [Fert] have a negative relationship with productivity, this could be explained base on the fact that the government do provide some fertilisers, but this has not been enough for all the farmers over the years.

CONCLUSION AND RECOMMENDATION

This study investigates how access to farm inputs through government aids affects agricultural productivity, and a potential tool for poverty alleviation. The above empirical results in all the six models, reported at least one positive relationship between the explanatory and dependent variables, thus, signifying a significant relationship between investment in agricultural inputs through government aids and agricultural productivity.

Thus, the researcher can accept the alternate hypotheses and reject the null hypotheses and this decision is in agreement with the previous studies of Timmer (1995), Mellor (1999), Byerlee et al. (2005), Datt and Ravallion (2007) and Schneider and Gugerty (2011).

Agricultural productivity has received a significant effect from investment through government aids and access to agricultural inputs as per all the six regression models. Therefore, an increase in agricultural productivity will lead to increased output, this can cause a decrease in real food prices, and this will trigger a high demand for food which will require more on-farm employment. This on-farm employment will increase farm household real income, that means the availability of income to demand non-food goods and services which would give rise to off-farm employment. Therefore, the increase in non-farming (off-farm) real household incomes would increase real wages that can eventually cause a decrease in the level of poverty. Hence, this can answer the research question posted earlier (RQ) *What is the impact of Government Aid on Agricultural productivity in The Gambia?*

Despite the enormous amount of agricultural aid coming into the country from donor organisations, until now, no significant upliftment of farmers and their families from abject poverty. Therefore, it is prudent to explore the specific-target investment approach to the agricultural sector of the Gambia and focus on the most productive subsectors for immediate impact on the living standard of the people. The establishment of a government agency to oversee the specific-target investment in agricultural sector and the effective implementation of the proposed agency model can produce a significant result in the quest to attain the Gambia's major national development policies, such as the National Social Protection Policy (2015–2025), National Development Plan (2018–2022) and the Sustainable Development Goals (2016–2030), as agricultural sector is regarded as major priority sector in the realisation of the country's development plan.

REFERENCES

Byerlee, D., Diao, X., Jackson, C. (2005). Agriculture, Rural, Development and Pro-Poor Growth: Country Experiences in the Post-Reform Era. Washington, DC: The World Bank: Agriculture and Rural Development Discussion Paper 21.

Datt, G., Ravallion, M. (2007). Farm Productivity and Rural Poverty in India. J. Dev. Stud., 34(4), 62–85. https://doi.org/10.1080/00220389808422529

Mellor, J.W. (1999). Faster More Equitable Growth - The Relation Between Growth in Agriculture and Poverty Reduction: Agricultural Policy Development Project Research Report No. 4. Washington DC: United States Agency for International Development.

Schneider, K., Gugerty, M.K. (2011). Agricultural Productivity and Poverty Reduction: Linkages and Pathways. The Evans School Review, 1(1), 56–74.

Timmer, C.P. (1995). Getting agriculture moving: do markets provide the right signals? Food Policy, 20(5), 455–472.

ZWIĄZEK MIĘDZY POMOCĄ RZĄDOWĄ A WYDAJNOŚCIĄ ROLNICTWA: POTENCJALNE NARZĘDZIE OGRANICZANIA UBÓSTWA W GAMBII PO COVID-19: ANALIZA EMPIRYCZNA (CZĘŚĆ 2: BADANIA I DYSKUSJE)

Abstrakt. Opracowanie jest kontynuacją rozważań teoretycznych związanych z problemem ubóstwa na świecie oraz roli, którą w rozwiązaniu tego problemu odgrywa rolnictwo. W opracowaniu zastosowano model korekty błędów (ECM) i technikę OLS do empirycznej analizy powiązań między pomocą rządową a wydajnością. Wykorzystując dane szeregu czasowego z 27 lat, oszacowano sześć różnych modeli regresji w celu określenia efektów przyczynowych następujących zmiennych objaśniających (nawozów, pestycydów, dostępności ziemi do działalności rolniczej i pomocy rządowej dla rolników) na sześć zmiennych zależnych, takich jak: warzywa, ryż niełuskany, orzech ziemny, kukurydza, proso i sorgo. Wyniki wskazują na pozytywny związek pomiędzy pomocą rządową w formie środków produkcji rolnej a wydajnością. Jednakże nawóz ma negatywny wpływ na ryż paddy, orzeszki ziemne, kukurydzę, proso i sorgo; jest to wynik niewystarczającej podaży nawozów przez rząd dla rolników. Tak więc empirycznie ustalono, że na produktywność wpływa jakość i ilość pomocy rządowej w formie środków produkcji rolnej.

Słowa kluczowe: ubóstwo, COVID-19, inwestycje rolne, wydajność rolnictwa