

Aid, Domestic Governance, and Agricultural Growth in Developing Countries

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Abstract

This study departed from other agricultural aid-growth studies by measuring growth as the annual growth rate of agricultural value added and accounting for the moderating role of governance on the aid-growth effect. Using data on a panel of 117 developing countries from 1996 to 2020, aid negatively influenced agricultural growth. Governance had a negative but insignificant independent effect on growth. However, the interaction of governance with aid turned the aid-growth effect from a significant negative to a statistically insignificantly positive effect. Since the low level of governance produced the positive interaction effect, of the aid-growth relationship, escalation of (good) governance could produce a strong effect.

Keywords

Agricultural aid, agricultural growth, aid-effectiveness, developing countries, governance.

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Introduction

The agricultural sector's growth is two to four times more effective in raising incomes among the poorest than other sectors, accounting for four per cent of global gross domestic product (GDP), and in some developing countries, representing more than 25% of GDP (International Development Agency, 2021). These notwithstanding, developing economies still rely on food imports with scarce foreign exchange with the associated logistical challenges. Supply shocks to the global food system such as the reduction in grain supplies from Ukraine and Russia due to the Russia-Ukraine conflict are evidence. Aside from foreign investment, developing countries have received foreign aid in the form of grants or loans at favourable rates, whose purpose is to finance programmes to improve living conditions in recipient countries (Alabi, 2014; Shaibu and Shaibu, 2022). Some of the specific uses include improved seeds and soils, roads to connect food production centres to markets, agribusiness credit and private sector investments, and training and technology transfer (Alabi, 2014). This helps start-up projects in sectors or areas that have been left behind (Shaibu and Shaibu, 2022).

The debate on aid effectiveness is not settled. Some have argued that aid enhances growth (Stiglitz, 2002; Stiglitz and Charlton, 2006). The proponents explain that financial flows in the form of development aid substitute for the lack of national savings that subsequently increase the stock of capital, which encourages investment by reducing rates and costs of loans. Thus, aid improves the living conditions and health of workers in the receiving countries, which transmits to the productivity and performance of employees in addition to promoting the exchange of knowledge and technology between rich and poor countries (Yahyaoui et al., 2019). Burnside and Dollar (2000, 2004) and Isham et al. (1997) noted that the positive effect of aid on growth is contingent on policies and institutions. Additionally, rampant inflation, unsustainable budget deficit or a situation of trade closure increases the risk of foreign support policies failing and requiring internal reform. On the other hand, Bauer and Yamey, (1982), Boone (1996), Mallik (2008) and Young and Sheehan (2014) have found a negative effect of aid on growth. They attributed this in large part to the lack of responsibilities of public officials seeking their interests in an environment of heavy corruption

and bureaucracy (Yahyaoui et al., 2019). Others have taken a middle ground, that aid does not affect growth (Adedokun, 2017; Dowling and Hiemenz, 1982; Mosley, 1980; Singh 1985; Stiernstedt, 2010). The neutral effect can turn into a positive effect with the role of good governance (Adedokun, 2017; Stiernstedt, 2010). Governance is a complex interaction system between the structures, features and processes characterised by transparency, responsibility, and involvement (USAID, 2002). Viewed also as executive, economic, and political authority, it regulates the affairs of a country at every level. This includes articulating thoughts and exercising civil liberties (Awan et al., 2018; UNDP, 1997). The use of governance tools such as transparency, responsibility, and involvement must enhance the distribution and utilisation of foreign aid. In developing countries where corruption and poor governance is a concern for development partners, good governance in foreign aid will reduce corruption, encourage investment and ultimately, growth. The aid-growth effects described relate to the total economy. As the agricultural sector is the world's largest employer and with international goals to double income for smallholders (World Bank, 2022a), what is the effect of agricultural aid on agricultural growth in developing countries? Does governance moderate the aid-growth effect as in the case of Adedokun (2017) and Stiernstedt (2010)?

Hansen and Tarp (2001) split the aid-growth studies into three. The first is influenced by the Harrod-Domar model (Harrod, 1939; Domar, 1946), and the two-gap Chenery-Strout (Chenery and Strout, 1966) extension (Arndt, Jones, and Tarp, 2010). Underlying the Harrod-Domar model is a stable linear relationship between growth and investment in physical capital. If all aid is invested, one can calculate the aid required to attain a targeted growth rate. In this vein, the aid-growth relationship is positive. The second set of studies investigated the aid-investment-growth link directly and not through savings. This should lead to a positive link between aid and investment. The first two positions were, however, criticised. Easterly (1999, 2003) noted that growth is less related to physical capital investment than often assumed by the Harrod-Domar and two-gap approach. Also, the problem of endogeneity surfaced. That is, more aid will be induced by poor economic performance. Insights from new theories of economic growth also influenced the research agenda. The third recognised endogeneity and possible non-linear relationship between aid and growth (Veiderpass and Andersson,

2011). Other studies have noted the importance of the policy and governance environment within which aid-growth relationship occurs (Adedokun, 2017; Burnside and Dollar, 2000; Stiernstedt, 2010). The role of governance in managing foreign aid is expected to positively impact the aid-growth effect (Rodrik, 2000). Adedokun (2017) explained that good governance reduces rent-seeking activities and corruption, and thus encourages investment leading to growth.

Some gaps exist in the agricultural aid-growth literature. First, existing agricultural growth studies have measured agricultural growth as output, input utilisation and total factor productivity (Alabi, 2014; Gebremariam, 2018; Ighodaro and Nwaogwugwu, 2015; Kaya, Kaya, and Gunter, 2012; Shaibu and Shaibu, 2022; Waya, 2020). The estimated relationship does not adequately reflect the rate of change of the dependent variable due to aid. Second, although Aljonaid et al. (2022) measured growth as the annual growth of agricultural GDP, the study focused on sub-Saharan African countries. Third, neither the independent role of governance nor the interactive effect of the aid-growth effect was investigated in the agriculture studies. We fill these gaps by firstly, appropriately defining agricultural growth as change over time, measured as the annual growth rate of agricultural GDP. Secondly, we focus on developing countries. Thirdly, while we assess the effect of aid and governance independently on agricultural growth, we also studied the interaction effect of governance on the agricultural aid-agricultural growth relationship.

In filling these gaps, we used data on a panel of 117 developing countries from 1996 to 2020. Aid negatively influenced agricultural growth. The moderating effect of governance turned the negativity of the aid-growth effect into a positive but statistically insignificant one. Further enhancement in governance could cause a desirable significant effect.

Materials and methods

Models and modelling

Based on the objectives and the existing literature on the total economy (Abbas et al., 2022; Adedokun, 2017; Akramov, 2012; Djokoto, 2023a; Maruta et al., 2020; Mwakalila, 2019; Nwaogu and Ryan, 2015; Stojanov et al., 2013, 2019; Stiernstedt, 2010), we specify two equations:

$$GROWTH_{it} = \alpha_0 + \alpha_1 AID_{it} + \alpha_2 GG_{it} + \alpha_3 FDI_{it} + \alpha_4 DI_{it} + \alpha_5 INFRA_{it} + \alpha_6 INFLA_{it} + \alpha_7 TO_{it} + \alpha_8 POPG_{it} + \alpha_9 L.LNAGDP_{it} + \epsilon_{it} \quad (1)$$

To take account of the moderation role of *GG* on the growth effect of aid, an additional variable is created, the interaction of *AID* and *GG* to produce *AID x GG*. This is introduced into Equation 2 to yield Equation 3.

$$GROWTH_{it} = \beta_0 + \beta_1 AID_{it} + \beta_2 GG_{it} + \beta_3 AID \times GG_{it} + \beta_4 FDI_{it} + \beta_5 DI_{it} + \beta_6 INFRA_{it} + \beta_7 INFLA_{it} + \beta_8 TO_{it} + \beta_9 POPG_{it} + \beta_{10} L.LNAGDP_{it} + \epsilon_{it} \quad (2)$$

α_k and β_j are parameters to be estimated. *i* and *t* are respectively cross-section and time dimensions of the data, respectively. ϵ_{it} and ϵ_{it} are idiosyncratic error terms. The moderation of governance on the aid-growth effect is β_3 .

GROWTH is agricultural growth, measured as the annual growth rate of agricultural value added in 2015 prices. This is the growth of real agricultural GDP. Economic growth has been measured similarly in the literature (Abbas et al., 2022; Maruta et al., 2020; Nwaogu and Ryan, 2015; Stojanov et al., 2013, 2019). *AID* is the net official development assistance and official aid received in current US dollars for all of agriculture, forestry, and fishing as a ratio of agriculture value added in current US dollars as used in the literature (Alabi, 2014; Djokoto et al., 2022; Gebremariam, 2018; Waya, 2020). *GG* is governance, measured with six indices, namely, political stability, corruption, government effectiveness, rule of law, regulatory quality and voice and accountability and composed into a single index as the average rank of each country in the panel for each year (Asongu and Nwachukwu, 2016; Bořa-Avram et al., 2018; Davis, 2017; Sarpong and Bein, 2021; Stojanović et al., 2016). The context of governance in this study relates more to domestic governance than international relations. *FDI* is foreign direct investment inflow into agriculture. Owing to limited observations at the data source, *FDI* was defined as 1 if the country received foreign direct investment in any year and 0 otherwise (Djokoto, 2023b). Foreign capital augments domestic agricultural capital. This should influence agricultural growth. The sum of equity capital reinvested earnings and other *FDI* capital is *FDI* (FAOSTAT, 2023a). *DI* is a domestic investment in agriculture, defined as gross fixed capital formation in agriculture to agricultural GDP. According to FAOSTAT

(2023b), this covers costs such as the total value of a producer's acquisitions, disposals of fixed assets during the accounting period plus certain additions to the value of non-produced assets realised by the productive activity of institutional units. This is relevant for production. The proxy for infrastructure (*INFRA*) is the sum of mobile and fixed phone subscriptions per 1000 people. The original data was per 100 people. The expression in terms of 1000 people is necessary to reduce the size of the values to be comparable to those of the other variables. Infrastructure forms the backbone of an economy. *INFLA* is the annual growth rate of the consumer price index, inflation. An increase in inflation reduces the purchasing power of consumers and vice versa and can affect agricultural growth. *TO* is trade openness, computed as the sum of exports and imports divided by the gross domestic product, all measures for the agricultural sector. Beyond globalisation, trade is essential in providing both raw materials and semi and finished products for the agricultural sector. Thus, *TO* has implications for agricultural growth. *POPG* is the annual growth rate of the population of both sexes. Aside from providing manpower for the economy including the agricultural sector, population growth contributes to the market for agricultural products. Thus, *POPG* must have implications for agricultural growth. *L.LNAGDP* is the initial level of agricultural GDP. This is different from the one-year lag of *GROWTH*.

Data

Data on *AID*, *FDI*, *DI*, and ingredients for computing *TO* were obtained from FAOSTAT (2023c), whilst data on *GG*, *INFRA*, *INFLA* and *POPG* were sourced from the World Bank (2023). The variables, descriptions, measurement, and sources are summarised in Table 1. The data covered 1996 to 2020 for 117 developing countries listed in the appendix. The availability of *GG* data from 1996 limited the start date of the data else all others started from 1991. The observations totalled 2,645.

Variable	Description	Measurement	Source
<i>GROWTH</i>	Agricultural growth	Annual growth rate of agricultural value added in 2015 prices.	FAOSTAT (2023c)
<i>AID</i>	Aid to agriculture	Net official development assistance and official aid received in current US dollars for all of agriculture, forestry, and fishing as a ratio of agriculture value added in current US dollars	
<i>FDI</i>	Foreign direct investment inflow into agriculture.	FDI was defined as 1 if the country received foreign direct investment in any year and 0 otherwise.	
<i>LLNAGDP</i>	Agricultural GDP	Initial level of agricultural GDP	
<i>DI</i>	Domestic investment in agriculture	Ratio of gross fixed capital formation in agriculture to agricultural GDP.	
<i>GG</i>	Governance indicator	Measured with six indices, namely, political stability, corruption, government effectiveness, rule of law, regulatory quality and voice and accountability and composed into a single index as the average rank of each country in the panel for each year.	World Bank (2023)
<i>INFRA</i>	Infrastructure	sum of mobile and fixed phone subscriptions per 1000 people.	
<i>INFLA</i>	Inflation	Annual growth rate of the consumer price index	
<i>TO</i>	Trade openness	The sum of exports and imports divided by the gross domestic product, all measures for the agricultural sector.	
<i>POPG</i>	Population	The annual growth rate of the population of both sexes.	

Source: FAOSTAT (2023c), World Bank (2023)

Table 1: Variables, descriptions, measurement, and sources.

Estimations and tests

Equations 1 and 2 were estimated using fixed effects (FE) and random effects (RE) estimators. The Hausman test (Hausman, 1978) was used to choose between the two. Appropriate tests were applied to test the possible violations of classical linear regression assumptions. Heteroscedasticity in the FE model was tested using the Modified Wald test for groupwise heteroskedasticity in the fixed effect regression model (Greene, 2000). In the case of RE, the Breusch and Pagan Lagrangian multiplier test for random effects (Breusch and Pagan, 1980) was employed. The Wooldridge test for autocorrelation in panel data (Wooldridge, 2002) was applied for both the FE and RE models. The variance inflation factor (VIF) was applied to test for multicollinearity. In line with the theoretical literature (Veiderpass and Andersson, 2011), endogeneity was suspected between *AID*, *FDI* and *DI* on one hand and *GROWTH* on the other hand. Hence, the general method of moments (GMM) was applied to equations 1 and 2 as a solution (Arellano and Bond 1991; Arellano and Bover, 1995). This approach was chosen because it is robust

to heteroscedasticity and serial correlation (Anatolyev, 2005; Wooldridge, 2001).

Results and discussion

Background of the data

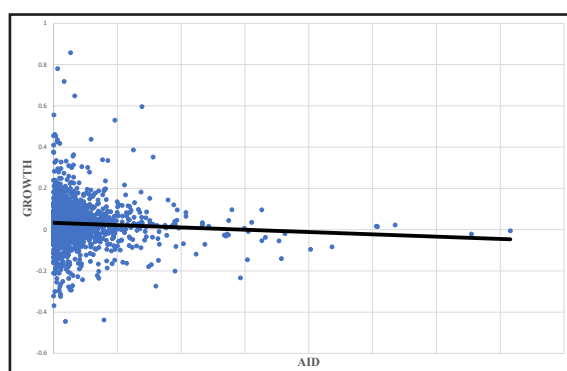
Agricultural growth recorded a minimum of -0.4449 (Central African Republic in 2013) and a maximum of 0.8573 (Palestine in 2004) (Table 2). The mean of 0.0300 coincided with that of Egypt, in 2013 and Indonesia in 2010. Some countries received zero aid whilst the country with the highest aid-to-agricultural GDP is Saint Kitts and Nevis with 0.7158 in 1998. This is not surprising because the Small States are heavily dependent on aid (Collier and Dollar, 1999, Narteh-Yoe et al., 2022) due to external shocks over which they have little or no control (World Bank, 2022b). The average of the governance indicator is 32.0980. This is less than half of the maximum of 74.0037 for Barbados in 2000. The minimum of 0.8818 is for Iraq in 2004.

Based on the literature, we assessed the non-linearity of the *AID- GROWTH* relationship. The trend line of the scatterplot of growth and aid

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
<i>GROWTH</i>	2,645	0.0300	0.0857	-0.4449	0.8573
<i>AID</i>	2,645	0.0283	0.0476	0	0.7158
<i>FDI</i>	2,645	0.2378	0.4252	0	1
<i>DI</i>	2,645	0.0944	0.0531	0.0019	0.4318
<i>INFRA</i>	2,645	6.1717	5.2170	0	23.6958
<i>INFLA</i>	2,645	0.0944	0.8341	-0.1811	41.4511
<i>TO</i>	2,645	1.1468	2.4273	0	45.1502
<i>POPG</i>	2,645	0.0188	0.0125	-0.0514	0.1809
<i>GG</i>	2,645	32.1278	16.7760	0.8818	74.0037
<i>AID x GG</i>	2,645	1.0394	2.5557	0	41.9216
<i>LI.LNAGGDP</i>	2,528	21.1264	2.1426	14.9560	27.6940

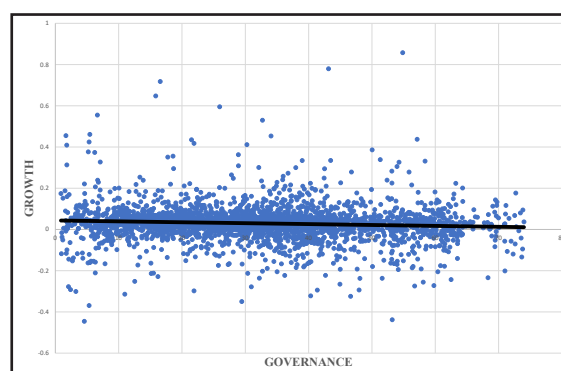
Source: Authors' elaboration

Table 2: Descriptive statistics.



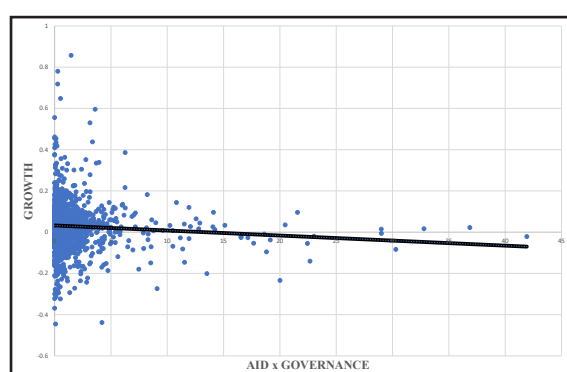
Source: Authors' elaboration

Figure 1: Scatter plot and trendline of growth and aid for developing countries.



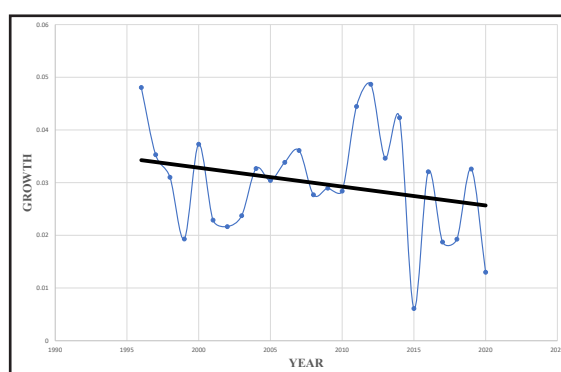
Source: Authors' elaboration

Figure 2: Scatter plot and trend line of growth and good governance of developing countries.



Source: Authors' elaboration

Figure 3: Scatter plot and the trend line of growth and interaction of aid and good governance in agricultural developing countries.



Source: Authors' elaboration

Figure 4: Scatter plot and the trend line of growth and interaction of aid and good governance in agricultural developing countries.

(*AID-GROWTH*) has a negative slope (Figure 1). That of growth and governance (*GG- GROWTH*) is also negatively sloping (Figure 2) but gentler than the previous. That of *AIDxGG -GROWTH* is also negatively sloping (Figure 3) but the strength of the slope appears to be between the other two (Figures 1 and 2). We did not find the non-linearity

as pointed out by Veiderpass and Andersson (2011). From 1996 to 2020, growth has been declining based on the trend line in Figure 4. As the relationship captured by the trend lines is bivariate, the role of other variables that are known to explain growth is accounted for and reported in the next section.

Results

The results of the FE (model 1) and RE (model 2) are presented in Table 3.

	(1)	(2)
VARIABLES	<i>GROWTH</i>	<i>GROWTH</i>
<i>AID</i>	-0.0827* (0.0432)	-0.0784* (0.042)
<i>GG</i>	0.0002 (0.0004)	0.0002 (0.0002)
<i>FDI</i>	0.0006 (0.0058)	0.0035 (0.0055)
<i>DI</i>	-0.1381* (0.078)	-0.0636 (0.0647)
<i>INFRA</i>	0.0027** (0.0006)	-0.0006 (0.0004)
<i>INFLA</i>	-0.0191** (0.0094)	-0.0154* (0.0091)
<i>TO</i>	-0.0034** (0.0014)	-0.0027 (0.0013)
<i>POPG</i>	0.2565 (0.2341)	0.4046* (0.2151)
<i>L1.LNAGGDP</i>	-0.0280*** (0.0051)	0.0058** (0.0024)
Constant	0.6115** (0.1065)	0.1588*** (0.0517)
Model diagnostics		
Observations	2,527	2,527
Countries	117	117
F test	4.9300***	21.0800**
Heteroscedasticity test	3.3e+05 ***	0
Serial correlation test	4.0090**	
Multicollinearity test (VIF)	1.92	
Specification test (Hausman)	30.0100**	

Source: Authors' elaboration

Table 3: Fixed and random effects estimations and robustness of estimates of AID.

The Greene (2000) test for heteroscedasticity showed that the variances are not constant in the FE. For the RE model, the null hypothesis of the Breusch and Pagan (1980) test could not be rejected. Applying Wooldridge's test for autocorrelation in panel data (Wooldridge, 2002), the null hypothesis of no first-order serial correlation was rejected. Regarding multicollinearity, the highest VIF is 1.92, far less than the threshold of 10. The null hypothesis of the Hausman test (Hausman, 1978), the differences in coefficients are not systematic, was rejected. Thus, the FE is preferred to the RE. Notwithstanding preference

for the FE, the estimates of *AID* and *GG* are similar in magnitude and statistical significance in the FE and RE models. This suggests the robustness of the key estimates to the estimators. Macroeconomic variables tend to present endogeneity problems. To account for this, the GMM was applied as it controls not only for endogeneity but is also robust to serial correlation and heteroscedasticity found in model 1 (Anatolyev, 2005; Wooldridge, 2001).

Table 4 presents an assessment of the robustness of the estimates of *AID* to the control variables. For models 3 – 12, the coefficient of *AID* is 0.10 with a negative sign. The standard errors range from 0.014 to 0.016. As a result, the null hypothesis that the estimates are statistically indistinguishable from 0 is rejected at least at a 1% level of probability. Thus, the estimates of *AID* are robust to estimators and control variables.

As noted earlier, some total economy studies have recognised the influences of governance on the aid-growth relationship. To assess this in the case of the agricultural sector, model 21 is estimated and the robustness of the estimates of *AID*, *GG*, and *AID x GG* to the control variables is assessed in models 13 – 20 (Table 5). The estimates of the three variables appear to be similar across all the models: magnitude, sign, and statistical insignificance of the coefficients.

	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH
<i>L.GROWTH</i>	-0.06950*** (0.01439)	-0.06953*** (0.01439)	-0.06913*** (0.01445)	-0.06972*** (0.01463)	-0.07083*** (0.01445)	-0.06927*** (0.01386)	-0.06997*** (0.01398)	-0.06870*** (0.01436)	-0.12383*** (0.01535)	-0.11068*** (0.01631)
<i>AID</i>	-0.18893*** (0.0235)	-0.18852*** (0.0235)	-0.18831*** (0.02345)	-0.19025*** (0.02333)	-0.18870*** (0.02305)	-0.20287*** (0.02432)	-0.18810*** (0.0231)	-0.18756*** (0.02359)	-0.17089*** (0.02926)	-0.17062*** (0.02886)
<i>FDI</i>		0.00698* (0.00423)								0.00529 (0.00454)
<i>DI</i>			-0.03012 (0.12668)							-0.06063 (0.11297)
<i>INFRA</i>				-0.00013 (0.00101)						0.00431*** (0.0009)
<i>INFLA</i>					-0.01335** (0.00607)					-0.02285*** (0.00809)
<i>TO</i>						-0.01834*** (0.00634)				-0.01641** (0.00708)
<i>POPG</i>							0.25429 (0.23926)			0.08799 (0.21298)
<i>GG</i>								-0.00019 (0.00054)		-0.00017 (0.00047)
<i>LLNAGGDP</i>									-0.12843*** (0.0144)	-0.13166*** (0.01665)
CONSTANT	0.03720*** (0.00144)	0.03541*** (0.00171)	0.04020*** (0.01219)	0.03805*** (0.00665)	0.03835*** (0.00143)	0.05459*** (0.0062)	0.03237*** (0.0047)	0.04405** (0.0175)	2.79613*** (0.29676)	2.87415*** (0.34456)
Model diagnostics										
Observations	2,411	2,411	2,410	2,411	2,411	2,411	2,411	2,411	2,411	2,410
Countries	116	116	116	116	116	116	116	116	116	116
Prob. (AR(2))	0.5503	0.5595	0.563	0.5479	0.5386	0.4997	0.545	0.5544	0.0725	0.1042
Prob. Sargan	0.3036	0.3126	0.3107	0.3002	0.3341	0.2905	0.31	0.2964	0.6027	0.7264
Instruments	47	48	48	48	48	48	48	48	48	55

Note: *** p<0.01, ** p<0.05,*** p<0.10. Values in parenthesis are robust standard errors.

Source: Authors' elaboration

Table 4: Robustness of AID estimates to control variables.

	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
VARIABLES	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH	GROWTH
<i>L.GROWTH</i>	-0.06874** (0.01435)	-0.06875*** (0.01435)	-0.06858*** (0.01443)	-0.06883*** (0.01460)	-0.07017*** (0.01442)	-0.06906*** (0.01387)	-0.06930*** (0.01397)	-0.12317*** (0.01532)	-0.11076*** (0.01628)
<i>AID</i>	-0.13807 (0.14680)	-0.13887 (0.14699)	-0.14350 (0.14561)	-0.13614 (0.14761)	-0.13498 (0.14569)	-0.20639 (0.15371)	-0.13755 (0.14630)	-0.21448 (0.16487)	-0.23690 (0.17252)
<i>GG</i>	-0.00021 (0.00054)	-0.00023 (0.00054)	-0.00025 (0.00055)	-0.00020 (0.00054)	-0.00024 (0.00054)	-0.00014 (0.00052)	-0.00023 (0.00054)	-0.00013 (0.00046)	-0.00020 (0.00047)
<i>AIDxGG</i>	-0.00091 (0.00255)	-0.00090 (0.00255)	-0.00079 (0.00252)	-0.00097 (0.00256)	-0.00098 (0.00254)	0.00021 (0.00266)	-0.00090 (0.00254)	0.00076 (0.00278)	0.00121 (0.00294)
<i>FDI</i>		0.00701* (0.00424)							0.00533 (0.00454)
<i>DI</i>			-0.04126 (0.12981)						-0.05455 (0.11180)
<i>INFRA</i>				-0.00005 (0.00101)					0.00431*** (0.00088)
<i>INFLA</i>					-0.01357** (0.00609)				-0.02265*** (0.00806)
<i>TO</i>						-0.01851*** (0.00629)			-0.01620** (0.00705)
<i>POPG</i>							0.25227 (0.22858)		0.08070 (0.21185)
<i>LLNAGGDP</i>								-0.12892*** (0.01426)	-0.13184*** (0.01654)
CONSTANT	0.04444** (0.01734)	0.04327** (0.01741)	0.04979*** (0.01726)	0.04411** (0.01893)	0.04649*** (0.01730)	0.06064*** (0.01795)	0.04013** (0.01749)	2.81262*** (0.29501)	2.87962*** (0.34174)
Model diagnostics									
Observations	2,411	2,411	2,410	2,411	2,411	2,411	2,411	2,411	2,410
Countries	116	116	116	116	116	116	116	116	116
Prob. (AR(2))	0.5559	0.5648	0.5679	0.5559	0.5422	0.4998	0.5495	0.0737	0.1045
Prob. Sargan	0.2925	0.3025	0.2987	0.2910	0.3250	0.2653	0.2980	0.6031	0.7284
Instruments	49	50	50	50	50	50	50	50	56

Note: *** p<0.01, ** p<0.05,*** p<0.10. Values in parenthesis are robust standard errors.

Source: Authors' elaboration

Table 5: Robustness of estimations for moderating effect of governance to control variables.

Discussion of control variables

The coefficients of *FDI*, *DI* and *POPG* are not consistent across all six models (Table 6).

	(12)	(21)
VARIABLES	<i>GROWTH</i>	<i>GROWTH</i>
<i>L.GROWTH</i>	-0.11068*** (0.01631)	-0.11076*** (0.01628)
<i>AID</i>	-0.17062*** (0.02886)	-0.23690 (0.17252)
<i>GG</i>	-0.00017 (0.00047)	-0.00020 (0.00047)
<i>AIDxGG</i>	-	0.00121 (0.00294)
<i>FDI</i>	0.00529 (0.00454)	0.00533 (0.00454)
<i>DI</i>	-0.06063 (0.11297)	-0.05455 (0.11180)
<i>INFRA</i>	0.00431*** (0.00090)	0.00431*** (0.00088)
<i>INFLA</i>	-0.02285*** (0.00809)	-0.02265*** (0.00806)
<i>TO</i>	-0.01641** (0.00708)	-0.01620** (0.00705)
<i>POPG</i>	0.08799 (0.21298)	0.08070 (0.21185)
<i>L.LNAGGDP</i>	-0.13166*** (0.01665)	-0.13184*** (0.01654)
<i>CONSTANT</i>	2.87415*** (0.34456)	2.87962*** (0.34174)
Model diagnostics		
Observations	2,410	2,410
Countries	116	116
Prob. (AR(2))	0.1042	0.1045
Prob. Sargan	0.7264	0.7284
Instruments	55	56

Note: *** p<0.01, ** p<0.05, *** p<0.10. Values in parenthesis are robust standard errors.

Source: Authors' elaboration

Table 6: Final estimations of aid on agricultural growth and the mediating role of governance.

The results of *INFRA* suggest a positive effect on agricultural growth. This is expected as infrastructure facilitates input supply, production, and marketing of agricultural produce. Although this proxy, subscription of fixed and mobile phone lines per 1000 people is for the total economy and not for agriculture alone, with changes in technology, there is high penetration of mobile phone technology. Thus, the positive sign of *INFRA* is understandable. Inflation (*INFLA*) hurts agricultural growth, consistent with Kaya et al. (2012) but contrary to the findings of Adedokun (2017). Inflation reduces

the purchasing power of the domestic currency. A decrease in the purchasing power of the currency would reduce investment, and how much food consumers can purchase which will ultimately reduce agricultural growth. *TO* is negative and statistically significant. This departs from the positive and statistically significant effect found by Adedokun (2017). The coefficient of the initial level of agricultural *GDP* (*L.LNAGGDP*), is negative and significant statistically. This means that as the initial agricultural *GDP* declines, agricultural output grows. This is logical because the increase in growth suggests current output is greater than the previous output.

Discussion of aid and governance effects on growth

The magnitude of the *AID-GROWTH* effect is negative and statistically significant. This implies a one US dollar increase in aid to agriculture will decrease agricultural growth by 0.17% (Table 7).

Effect	Student t-test	Wald test
Aid	-0.17062*** (0.02886)	34.9516***
Interaction effect of governance on aid-growth effect	0.0012 (0.0029)	0.1712

Note: *** p<0.01, ** p<0.05, *** p<0.10. Values in parenthesis are robust standard errors.

Source: Authors' elaboration

Table 7: Estimates of the growth effect of aid and the moderating role of good governance.

Aid in the form of financial resources is completely fungible whilst that as material could also be used for purposes other than what is intended. In the presence of corruption, which is high in some developing countries, both financial and material aid does find its way into anon-agricultural uses. The tendency to divert agricultural aid is further fuelled by the high level of poverty in developing countries. Although these areas may still be within the economy, as long these are not within the agricultural sector, the effect of agricultural aid would not be realised, hence the negative effect. The negative effect conforms to the relationship in Figure 1. As shown in Figure 3, growth decreased over time from 1996 to 2020. Thus, although *AID* may have increased, growth decreased. This is consistent with the use of agricultural *GDP* growth at constant 2015 prices as the dependent variable. It is worth noting that Adedokun (2017) and Stiernstedt (2010) found a negative but statistically insignificant effect,

whilst Aljonaïd et al. (2022) reported a positive effect. Kaya et al. (2012) found a positive effect of agricultural aid on economic growth in developing countries.

The magnitude of the interaction effect has turned positive following the moderation with governance. However, the magnitude is statistically indistinguishable from zero. The positive sign can be attributable to the influence of governance. The almost flat curve of the governance-growth relationship (Figure 2) may have influenced the results. Although the curve in Figure 3 slopes negatively and gently, the influence of the control variables and the governance factor caused the switch in sign. The statistical insignificance is due to the high standard errors of the GG coefficient in model 21. Whilst the effect of governance, a national indicator switched the sign of the interaction of the aid-growth effect, the influence is not sufficient to produce a statistically significant coefficient in the agricultural sector. Considering that the low mean governance rank of 32 produced a positive moderating effect, an enhanced level of governance can result in a statistically significant effect. The positive sign of the interaction effect is in line with the assertions of Rodrik (2000), albeit insignificant in our case. Developing countries can thus promote governance. Following this, its moderating effect is beneficial to the aid-growth relationship but weak. Our finding is consistent with the positive effect of Adedokun (2017) but departs from it based on the statistical significance. However, Stiernstedt (2010) found a positive and significant effect of the moderation role of governance.

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Conclusion

This study departed from other agricultural aid-growth studies by measuring growth as the annual growth rate of agricultural GDP and accounting for the moderating role of governance on the aid-growth effect. Aid negatively affected growth. Governance had a negative but insignificant independent effect on growth. Consequently, aid is not a good stimulus for agricultural growth just as governance is not. However, the influence of governance turned the aid-growth effect from negative to positive albeit still statistically insignificant. Considering that developing countries generally measure low on governance, which produces a positive but insignificant effect, significant enhancement in governance could have a significant effect. Governments in developing countries must accelerate governance beyond the current levels. As corruption has been concern in developing countries, reducing corruption through enhanced good governance would have a collateral effect on the aid-growth nexus. Infrastructure should be enhanced. This will not only benefit the agricultural sector but the larger economy. Although the agricultural growth has been associated with some level of inflation, reducing inflation, which is a macroeconomic goal, will also enhance agricultural growth. Further research can explore the agricultural aid-growth effect for transition countries. As this study used agricultural aid, recognising other types of agricultural aid could be interesting.

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