Kurdish Studies
Sep 2023
Volume: 11, No: 3, pp. 493-507
ISSN: 2051-4883 (Print) | ISSN 2051-4891 (Online)
www.KurdishStudies.net

Received: May 2023 Accepted: June 2023
DOI: https://doi.org/10.58262/ks.v11i3.036

Asymmetric Impact of Official Development Assistance on Agriculture Sector Growth of Pakistan in the Presence of Governance: A Nonlinear ARDL Approach

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Abstract

The study's objective is to examine the impact of official development assistance on agriculture growth in Pakistan. The novelty of the research lies to look into asymmetric role of official development assistance and by introducing governance indicators as interacting variables with official development assistance to see the combined effect on agriculture growth. The study used pre-Covid-19 data from 1985–2019 to analyze the pure effect of ODA, as, during the COVID-19 pandemic, aid largely flows to the health sector of the economy. The study applied a nonlinear ARDL technique to find the relationships among the variables. The results indicate that official development assistance affects agriculture growth asymmetrically. We also analyzed the moderating effects of corruption and political stability on the agriculture-growth. We found that the interacting effect of corruption has a positive impact on agricultural growth in the short and long term. Individually, corruption has a significant negative impact on agriculture's growth. Political stability's interactive influence has been statistically insignificant. Inflation and population are statistically unimportant, although population growth has a considerable positive effect on the agriculture sector in the short run. The study's findings include policy recommendations on official development aid adjustments that significantly impact Pakistan's agriculture sector growth.

Keywords: *Official Development Assistance, Agriculture Growth, Governance, NARDL.*

Introduction

For emerging countries, growth is still a heated issue. These countries are trapped in the vicious circle of targeted sectorial growth and have hardly achieved their aim. The necessary thing for developing economies is to achieve targeted sectorial growth to attain sustainable economic growth (Onafowora & Owoye, 2019), as foreign capital is one of the crucial elements required to achieve this objective (Sahoo, 2017). The need and importance for more external resources to spur domestically poor resource countries have been considered a source of economic growth and a means for economic coordination and development in most developing nations like Pakistan (Jawaid & Saleem, 2017; Musibau, Yusuf, & Gold, 2019). Foreign capital, like official development assistance (ODA), is an important growth factor. ODA is one of the important factor in funding developmental projects in developing economies and providing assistance to countries development (Hossain, 2014; Niyonkuru, 2016). Development aid is the primary source of recirculating global wealth and comprises financial inflows with the objective of economic growth (Gregl & Logožar, 2017).

The primary sector in any country can be considered an "engine of growth," especially in the initial

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developmental phase(Kaya, Kaya, & Gunter, 2013). The significance of the agricultural sector to the economy can be seen in three aspects: first, it supplies food to the inhabitants of the country; secondly, a source of foreign earnings; and thirdly, it creates a market for industrial commodities(Dixon, Gibbon, Gulliver, & Hall, 2001; Johnston & Mellor, 1961; Ranis, Stewart, & Reyes, 1990; Raza & Siddiqui, 2014; Timmer, 2002). Considerable evidence indicates that primary sector growth has a significant aggregate impact on reducing global poverty, particularly acute poverty (Bourguignon & Morrisson, 1998; Christiaensen, Demery, & Kuhl, 2011; Gollin, Parente, & Rogerson, 2002). The primary sector's productivity is heavily dependent on agriculture investment and conducive to creating employment (Lio & Liu, 2008; Yu, 2010).

Pakistan's agriculture industry contributes 18.5 percent to its GDP and employs 38.5 percent of the population, yet it is still a backward sector of the economy. Over the last decade, the agricultural sector's performance has fallen and the situation is dissatisfactory. For fiscal years 2012 to 2016, the agriculture sector's growth decreased from 2.68% to 0.15%, respectively, and merely increased in fiscal years 2017 to 2018 from 2.18% to 3.94%. Throughout 2018–19, agriculture continued to perform modestly. Against a goal of 3.8 percent, it only grew by 0.85 percent in 2019. (Economic Survey of Pakistan, 2018-19). A Food and Agriculture Organization (FAO) of the United Nations report reveals that world hunger is continuously increasing. The number of undernourished or food-deprived people is estimated to increase from approximately 804 million in 2016 to 821 million in 2017. If this situation persists and no effort is made, the Sustainable Development Goals to eradicate world hunger by 2030 are under threat (Food and Agriculture Organization, 2018). To eliminate poverty and hunger while protecting natural resources, food and agriculture have become a core objective of the 2030 Agenda for Sustainable Development (FAO, 2016).

It is admitted that agriculture plays a role in food security and poverty alleviation. A higher flow of foreign aid and grants significantly impact agriculture output (Effiong & Eke, 2016). The trend of overseas development assistance to Pakistan from 2012 to 2015 is massively increasing, going from 1.87 billion dollars to 3.76 billion dollars, respectively (World Bank, 2016). An increasing trend in ODA and lower agriculture growth in Pakistan make it attention-grabbing.

The absorptive capacity in agricultural aid investment is limited due to a lack of good institutions (Islam, 2011). Good governance is required for an effective foreign capital-growth relationship (Ndambendia & Njoupouognigni, 2010). The low quality of institutions is often connected with less investment, slow productiveness, reduced income per capita, and overall slow economic growth (Jude & Levieuge, 2017).

Less attention has been given to the sector-wise growth of an economy in Pakistan as most of the empirical literature has been conducted at an aggregate level. The primary objective of the research is to find the answer to the specific research questions; how ODA affects asymmetrically? And how interaction of governance indicators such as corruption control and political stability response to agriculture sector growth? Therefore, sectorial analysis is conducted to realize the performance and response of sector-wise changes in the inflows of ODA and to show its impact later on the entire economy of Pakistan. This paper will contribute to the literature in several ways because it produces novel results by examining the asymmetric impact of official development assistance on agriculture growth. Furthermore, we improve the methodology by using nonlinear ARDL for aid and agriculture growth relationship. Finally, we include the interaction of governance and ODA to see combined effect on agriculture growth in Pakistan. Research on this problem is vital because it could help policymakers better understand the possible effect of investments in agriculture. Thus, policy decisions on resource allocations could be improved. It will also contribute to future studies based on the findings of the interactive effect of governance for developing countries.

The rest of the paper is organized as follows: part two is the literature review; part three is the methodology section with data sources, part four is discussion of the results, and part five comprises on conclusion and policy recommendations section.

Literature Review

Foreign Aid is an official loan or grant that a nation (usually a developing one) receives to support its economic expansion and development. According to the theoretical support of aid and growth relationships, Solow and Harrod-Domar's models explain that overseas foreign Aid is required to increase investment and decrease inequalities (Ssozi, Asongu, & Amavilah, 2019). Aid reinvestment is effective for long-term development (Asongu, 2016). Foreign aid affects growth through developmental projects via investment rather than consumption. It is typically used to get close economic gaps like the savings gap (S-I), external financing gap (X-M), and fiscal gap (G-T) (Bacha, 1990; Fatima, 2014; Mallik, 2008; Taylor, 1990). H. A. S. Chenery (1966), claimed that foreign Aid boosts income and investment levels in the host economy by augmenting available domestic resources. Aid promotes growth when economic reforms take place (Bearce & Tirone, 2010) and impact less on growth but has a greater impact in the presence of good institutional policies (Alesina & Dollar, 2000; Burnside & Dollar, 2000). Morrissey (2001) asserts that overseas aid can be contributed to economic growth in different ways, including Aid increasing investment in the stock of physical and human capital; Aid boosts the capacity to import capital goods.; Aid has no indirect influence that lower the rate of investment and aid is linked to technological transfer that boosts capital productivity and encourages endogenous technological change. The premise of the aid-growth theory is that the accumulation of physical capital promotes economic growth. Aid efficacy is impressed by external and climatically surroundings; (iii) aid effect subject to political situations; and (iv) depends on the institutional quality (McGillivray, Feeny, Hermes, & Lensink, 2006).

Empirically, Economic growth in general and agriculture growth-specific literature have been included in the current study. The effect of foreign capital on economic growth has attracted valuable debate in the existing literature with inconsistent results. For instance, foreign capital inflows have positively impacted growth (Asteriou, 2009; Berument & Dincer, 2004; Burnside & Dollar, 2000; H. B. Chenery, 1967; Hansen & Tarp, 2001; Karamelikli & Bayar, 2015; Karras, 2006; Kentor & Boswell, 2003; Lumbila, 2005; Minoiu & Reddy, 2010; Ndambendia & Njoupouognigni, 2010; Pradhan, Upadhyay, & Upadhyaya, 2008). In contrast, while other found a negatively impact on growth or no effect at all on economic growth (Chami, Fullenkamp, & Jahjah, 2005; Chowdhury & Mavrotas, 2005; Cordella, Ricci, & Ruiz-Arranz, 2005; Easterly, 2003; Ekanayake & Chatrna, 2010; Mah, 2010; Mosley, Hudson, & Horrell, 1987; Pattillo, Poirson, & Ricci, 2002; Rajan & Subramanian, 2008; Chowdhury et al.,2021; Aziz et al.,2020;Sun et al.,2022;Arain et al.,2019;Meo et al.,2020;Numan et al.,2022)). Mallik (2008), found a long-run relationship with the negative aid-growth effect. In general, foreign aid-growth effects deviate from countries specifically studied.

This goes to inconclusive results in the existing literature. Many research studies have explained the association between foreign capital and economic growth in various developed and emerging economies. Mahembe and Odhiambo (2019), collected literature on foreign assistance effectiveness in reducing poverty. The study highlighted different channels through which foreign aid might prove effective. Firstly, aid works more in democratic system countries. Secondly, aid allocation in public expenditures such as agricultural, educational, betterment of health system and social service areas, manufacturing, and economic development projects work more in reducing poverty. The study suggested that policymakers should pay attention to these channels when decisions are made on aid allocation.

However, studies on the agriculture sector's analysis of foreign capital (ODA) relationships are minimal. Schudel (2008), argued that efficacy of aid depends upon the recipient country's corruption level. Pooled ordinary least squares and fixed effects methods were applied to determine corruption levels in both countries. Feeny and Ouattara (2009), analyzed overseas aid's effects on agriculture and industrial growth. GMM estimation has been applied, and findings suggest that aid has a significantly influence on agricultural income per capita, and consumption of aid positively influences industrial per capita growth. The study suggested that good policies are

necessary for the effectiveness of Aid for both sectors. Selaya and Thiele (2010), claimed that aid is allocated for competitiveness in underdeveloped countries and contributes to rising Dutch disease-related effects.

Kaya, Kaya, and Gunter (2012), examined the association of Aid in the agriculture sector of developing economies and found that aid has a significantly positive association with growth if aid is allocated to the agricultural sector. Ssozi et al. (2019), estimated aid effectiveness for the agriculture sector in their recent studies and found positive effect of ODA on agriculture growth. Institutional and economic indicators' roles were established in agriculture to enhance the effectiveness of official development aid. The structural changes connected with primary sector aid were also weakened. Barkat and Alsamara (2019), said that official development assistance might be augmented to support the agriculture sector and improve agricultural output.

Methodology and Data Source

To explore the role of official development assistance with the interactive effect of governance in agriculture growth in Pakistan, this study utilizes pre-covid-19 yearly data from 1995-2019 to check the pure effect of ODA on agriculture growth. The primary variable used in our study as an independent variable is official development assistance (ODA), agriculture growth as a dependent variable, population growth, and consumer price index proxy used for inflation are included as control variables for the smoothness of the results. The datasets used in this study were obtained from different sources, WDI (World Development Indicator, World Bank), WGI (Worldwide Governance Indicators, World Bank), and International Country Risk Guide (ICRG).

To probe the link between official development assistance and agriculture growth, we estimate the following equation:

$$GAGS_t = \alpha_0 + \alpha_1 ODA_t + \alpha_2 X_t + \varepsilon_t \ (1)$$

Where $GAGS_t$ refers to the growth of the agriculture sector, ODA is the official development assistance, andX_t; set of control variables mentioned above. ε_t represents error term, and t denotes the time, 1,2,3…

Following is the model specification.

$$LGAGS_t = \alpha_0 + \alpha_1 LODA_t + \alpha_2 LINF_t + \alpha_3 LPOPG_t + \varepsilon_t \ (2)$$

An empirically NARDL was proposed by Shin, Yu, and Greenwood-Nimmo (2014) to inspect the association between foreign capital like (ODA) and agriculture growth in Pakistan. There are several advantages by employing the ARDL method. Firstly, the benefits of ARDL are that it is applied to determine both long and short-run effects. Secondly, It treats variables in a different orders as I(0) and I(1). Thirdly, it tells about short-run coefficients and the long run speeds of adjustment.

The symmetric ARDL estimation is as follows:

$$\begin{aligned}\Delta LGARS_t = \ & a_{0i} + a_{1i}\Delta LGARS_{t-1} + a_{2i\Delta} LODA_{t-1} + a_{3i}\Delta LINF_{t-1} + a_{4i}\Delta LPOPG_{t-1} \\ & + \sum_{j=1}^{n} \beta_{1i}\Delta LGARG_{t-j} + \sum_{j=o}^{n} \beta_{2i}\Delta LODA_{t-j} + \sum_{j=o}^{n} \beta_{3i}\Delta LINF_{t-j} \\ & + \sum_{j=o}^{n} \beta_{4i}\Delta LPOPG_{t-j} + \varepsilon_t\end{aligned}$$

In the above equation of the agricultural growth model (3), the long run coefficients are shown by $\alpha_1, \alpha_2, \alpha_3 \ldots . \alpha_6$, and short run coefficients are demonstrated by $\beta_1, \beta_2, \beta_3 \ldots . \beta_6$. In equation (3), instrument variables are supposed to affect dependent variables symmetrically.

So, the ECM estimation is under,

$$\Delta LGARS_t = \ a_{0i} + \sum_{j=1}^{n} \beta_{1i}\Delta LGARG_{t-j} + \sum_{j=o}^{n} \beta_{2i}\Delta LODA_{t-j} + \sum_{j=o}^{n} \beta_{3i}\Delta LINF_{t-j} +$$

$\sum_{j=o}^{n} \beta_{4i} \Delta LPOPG_{t-j} + \lambda ECT_{-1} + vt$ (4)

λ shows the speed of adjustment, and ECT denotes the residuals in equation (4).

The asymmetric ARDL estimation is as follows:

Shin et al. (2014), have introduced the nonlinear ARDL method. For the purpose of finding the nonlinear effect of external capital on sectoral growth in Pakistan, we decompose the independent variable (ODA) into positive and negative components. This asymmetric regression $z_t = \theta^+ w_t{}^+ + \theta^- w_t{}^- + \mu_t$, where $\theta^+ and\ \theta^-$ are connected with long-run coefficients, vector of explanatory variables separated as

$$w_{it} = w_0 + w_t^+ + w_t^-$$

Where w_t^+ and w_t^- are regressors disintegrating into positive and negative. The following Eq. (6 to 7) are the partial sum of positive and negative alterations in ODA.

$$ODA^+ = \sum_{i=1}^{t} \Delta ODA_t^+ = \sum_{i=1}^{t} \max(\Delta ODA_{t,}0) \quad (6)$$

$$ODA^- = \sum_{i=1}^{t} \Delta ODA_t^- = \sum_{i=1}^{t} \min(\Delta ODA_{t,}0) \quad (7)$$

For asymmetric ARDL structure, place positive and negative series of equations created in Eq. (6 to 7) into Eq. (3 and 5) to get Eq. (8 to 9) asymmetric equations while Eq. (3 and 5) representing the symmetric agriculture ARDL equation respectively.

$\Delta LGARS_t = a_{0i} + a_{1i}\Delta LGARS_{t-1} + a^+{}_{2i}\Delta LODA_{t-1}^+ + a^-{}_{2i}\Delta LODA_{t-1}^- + a_{3i}\Delta LINF_{t-1} + a_{4i}\Delta LPOPG_{t-1} + \sum_{j=1}^{n}\beta_{1i}\Delta LGARG_{t-j} + \sum_{j=1}^{n}\beta^+{}_{2i}\Delta LODA_{t-j}^+ + \sum_{j=1}^{n}\beta^-{}_{2i}\Delta LODA_{t-j}^- + \sum_{j=o}^{n}\beta_{3i}\Delta LINF_{t-j} + \sum_{j=o}^{n}\beta_{4i}\Delta LPOPG_{t-j} + \varepsilon_t$ (8)

$a^+{}_2$ and $a^-{}_2$, $\beta^+{}_2$ and $\beta^-{}_2$ measure the asymmetric hypotheses in the short and long-run:

H0: $a^+{}_2 = a^-{}_2 = 0$

H0: $\sum_{j=1}^{n}\beta^+{}_{2i} = \sum_{j=1}^{n}\beta^-{}_{2i}$ for all i= 0,….,n

The interaction effect of ODA with Governance indicators equation is as follows:

$$\begin{aligned}\Delta LGARS_t = {} & a_{0i} + a_{1i}\Delta LGARS_{t-1} + a^+{}_{2i}\Delta LODA_{t-1}^+ + a^-{}_{2i}\Delta LODA_{t-1}^- + a_{3i}\Delta LINF_{t-1} \\ & + a_{4i}\Delta LPOPG_{t-1} + a_{7i}(\Delta LODA_{t-1} * \Delta LGI_{t-1}) + \sum_{j=1}^{n}\beta_{1i}\Delta LGARG_{t-j} \\ & + \sum_{j=1}^{n}\beta^+{}_{2i}\Delta LODA_{t-j}^+ + \sum_{j=1}^{n}\beta^-{}_{2i}\Delta LODA_{t-j}^- + \sum_{j=o}^{n}\beta_{3i}\Delta\, LINF_{t-j} \\ & + \sum_{j=o}^{n}\beta_{4i}LPOPG_{t-j} + \sum_{j=1}^{n}\beta_{7i}(\Delta LODA_{t-j} * \Delta LGI_{t-j}) + \varepsilon_t \quad (9)\end{aligned}$$

Results and Discussions

The preliminary tests, descriptive statistics, and correlation matrix elaborate on the variables' features. The mean agriculture sector growth is 3.499; official development assistance is 1.562; the inflation rate is 8.079, and population growth is 2.533. The maximum values of agriculture sector growth are 11.723, official development assistance is 3.095, the inflation rate is 20.286, and population growth is 2.417. The minimum values are-5.286, 0.448, 2.529, and 2.022 for agriculture growth, official development assistance, inflation, and population growth.

Unit root Tests

According to Dickey and Fuller (1979), the unit root test checks stationarity. Table 1 indicates that agriculture growth and official developmental aid are stationary at the level and the first differential. Inflation and population growth, for example, are non-stationary at their level but become stationary at the first difference.

Table 1: Unit root test results (ADF).

Variables	Level		1st Difference	
	Intercept	Intercept & Trend	Intercept	Intercept & Trend
GAGS	0.0000	0.0059	0.0000	0.0000
ODA	0.0656	0.0133	0.0000	0.0000
INF	0.0904	0.2719	0.0000	0.0000
POP	0.3598	0.9983	0.5203	0.0103

Nonlinear ARDL Model

Pesaran, Shin, and Smith (2001) developed the F-stat. Table 2 shows that the computed F-stat for cointegration is greater than the upper and lower bounds, confirming the long-run relationship between variables.

Table 2: Bound test results for Nonlinear Cointegration.

Nonlinear ARDL Model	F-Statistic	Sign in	Lower bound I(0)	Upper bound I(1)
	9.499363	10%	2.2	3.09
		5%	2.56	3.49
		1%	3.29	4.37

The optimal number of lags for (NARDL (2, 1, 0, 2, 2)), NARDL interaction with control of corruption (2, 1, 0, 1, 0, 0, 0) and interaction with political stability (3, 0, 0, 0, 0, 0, 0, 0, 0) are selected on the basis of AIC information. Before applying NARDL estimation, it is necessary to check the residual diagnostic test and results (bottom of table 3) that show no proof of serial correlation and heteroskedasticity.

Nonlinear ARDL Estimation Results

Table 3 & 4 elaborates that the coefficient of official development assistance is -1.560; meaning that 1 percent increase in official development assistance will result in 1.560 percent lessens the development of Pakistan's agriculture sector in the long run. The decreasing value of official development assistance is –0.782 at the 10% significance level, implying that a 1% decrease in ODA will boost 0.782% growth in agriculture Pakistan in LR, while in SR, the decreased value of official development is -1.327, explaining that a 1% decrease in ODA strengthens the growth of agriculture by 1.327%. The increased value of official development is -2.649, meaning that a 1% increase in official development assistance, 2.649% decreases the growth of agriculture in Pakistan. The results are compatible with those (Njangang, Nembot Ndeffo, Noubissi Domguia, & Fosto Koyeu, 2018; Yiew & Lau, 2018) as aid has an adverse effect on overall growth.

The control variables, inflation, and population growth, are insignificant with negative coefficient signs in the long run, while inflation is insignificant and population growth has a significant positive effect in the short run. The ECT is significant with a negative sign that ensures the long-run speed of adjustment of the variables.

Table 3: Nonlinear ARDL Estimation and Diagnostic Test Results (Without Interaction Term).Long run Estimation

Variables	Coefficient	p-value
LODA_POS	-1.560590	(0.0042)
LODA_NEG	-0.782000	(0.0647)
LINF	-0.142687	(0.5633)
LPOPG	-3.828646	(0.4479)
C	6.099626	(0.3194)

Note: *, **, and *** shows 1%, 5% and 10% significance level; () are p-values.

Table 4: Nonlinear ARDL Estimation and Diagnostic Test Results (Without Interaction Term) Short run Estimation.

Variables	Coefficient	p-value
C	10.35747	(0.3325)
LGAGS(-1)*	-1.698050	(0.0000)
LODA_POS(-1)	-2.649960	(0.0023)
LODA_NEG**	-1.327875	(0.0375)
LINF(-1)	-0.242289	(0.5613)
LPOPG(-1)	-6.501233	(0.4559)
D(LGAGS(-1))	0.194794	(0.2785)
D(LODA_POS)	-0.491929	(0.5643)
D(LINF)	-1.213763	(0.5643)
D(LINF(-1))	0.565385	(0.2089)
D(LPOPG)	69.58330	(0.0435)
D(LPOPG(-1))	-101.5819	(0.0095)
ECT	-1.698050	(0.0000)
R^2	0.901954	
Adj. R^2	0.872541	
F-Stat	4.921902	(0.002657)
LM Test	2.476234	(0.2899)
J.B Test	0.398798	(0.819223)
Hetro Test	13.37426	(0.2696)
CUSUM	S	
CUSUMSQ	S	
W_{LR}	978.2473	(0.0000)
W_{SR}	10.58388	(0.0042)

Note: *, **, and *** shows 1%, 5% and 10% significance level; () are p-values.

And WLR, WSR: Wald test for the long run and short run asymmetry.

The cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) methods are used to check stability, and the results are shown in the appendices in figures 1A to 6A. The Wald test for the long run (WLR) and the short run (WSR) was used to confirm the applicability of an asymmetric model, with the findings shown in Table 4 confirming long and short run asymmetry. Dynamic multiplier graphs show the asymmetry behavior of positive and negative LODA adjustments on agricultural growth. The vertical axis of the multiplier graph in figures 1 to 3 displays the amount of the effect on the vertical axis, while the horizontal axis represents the years until the long-run equilibrium level is achieved.

Figure 1A: Plot CUSUM.

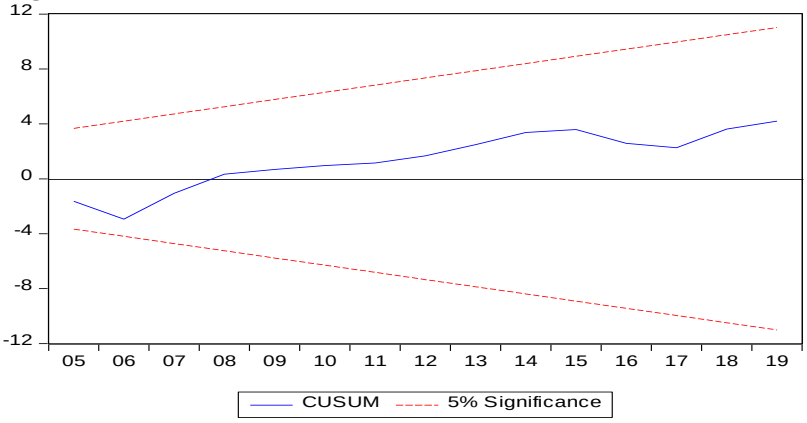


Figure 2A: Plot CUSUMQ.

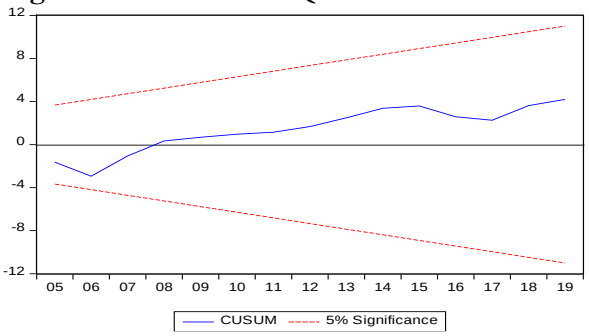
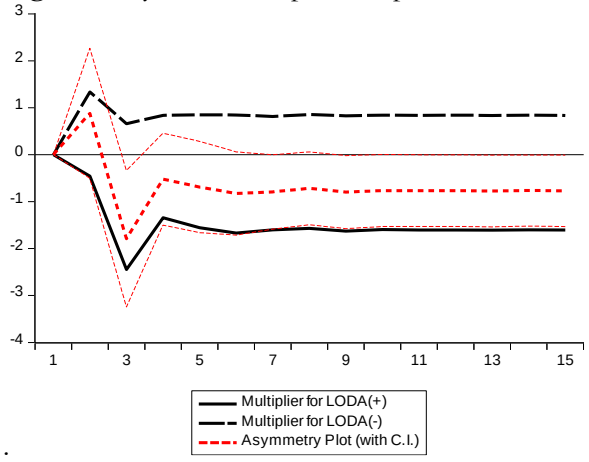


Figure 1: Dynamic Multiplier Graph.



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Moreover, the study also checks the asymmetric impact of official developmental assistance on agriculture by employing NARDL (with interaction) of governance indicators (control of corruption and political stability). Table 5 & 6 reveals the outcomes of the joint effects of official development assistance and corruption. Individually, corruption has a significant negative effect on agriculture by supporting the theoretical arguments that corruption hinders the way of growth, as a 1% increase in corruption will decrease 6.807% in agriculture output in the long-run, and a 10.786% will lead to a decline in the short-run. While the combined effect has a significantly positive influence on agriculture sector growth, in the long run, meaning that a 1% change in control of corruption may change the impact of official development assistance, agriculture growth is expected to be 16.29% in the long run and 25.821% in the short run. The short-run significances and signs are the same as the long-run in that corruption has a significant negative effect on agriculture, while the combined influence of ODA and CC has a significant positive effect.

Table 5: Nonlinear ARDL Estimation and Diagnostic Test Results (With Interaction Term CC) Long Run Estimation.

Variables	Coefficient	p-value
LODA_POS	-12.73172	(0.0134)
LODA_NEG	-11.83817	(0.0186)
LINK	0.053362	(0.8194)
LPG	-4.680065	(0.3707)
LCC	-6.807853	(0.0028)
LODA*LCC	16.29723	(0.0216)
C	2.974574	(0.6232)

Note: *, **, and *** shows 1%, 5% and 10% significance level; () are p-values.

Table 6: Nonlinear ARDL Estimation and Diagnostic Test Results (With Interaction Term CC) Short run estimation.

Variables	Coefficient	p-value
C	4.712917	(0.6235)
LGAGS(-1)*	-1.584401	(0.0000)
LODA_POS(-1)	-20.17215	(0.0052)
LODA_NEG**	-18.75640	(0.0084)
LINF(-1)	0.084547	(0.8198)
LPOPG**	-7.415099	(0.3630)
LCC**	-10.78637	(0.0008)
LODA*LCC**	25.82134	(0.0105)
D(LGAGS(-1))	0.256303	(0.1012)
D(LODA_POS)	-18.43655	(0.0094)
D(LINF)	-1.318247	(0.0040)
ECT	-1.584401	(0.0000)
R^2	0.924822	
Adj. R^2	0.914083	
F-Stat	6.899516	(0.000679)
LM Test	2.998066	(0.2233)
J.B Test	0.673610	(0.714048)
Hetro Test	9.512378	(0.4843)
CUSTOM	S	
CUSUMSQ	S	

Note: *, **, and *** shows 1%, 5% and 10% significance level; () are p-values.

Figure 3A: Plot CUSUM.

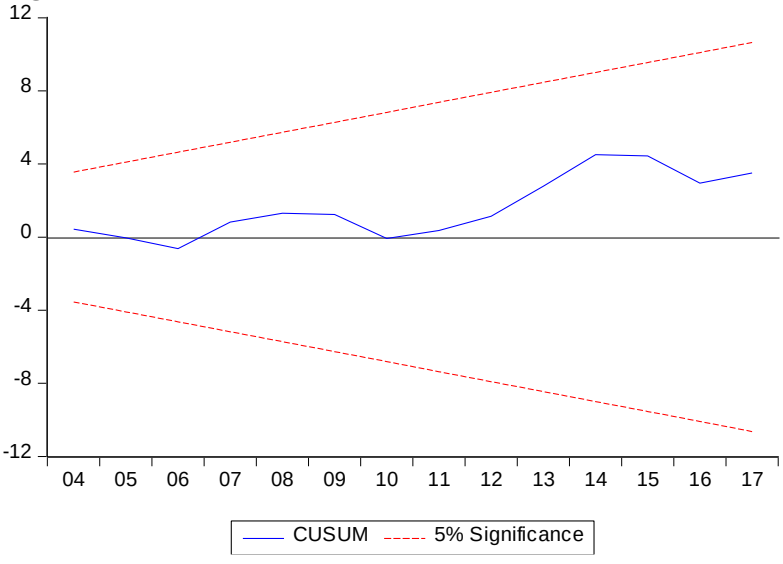


Figure 4A: Plot CUSUMQ.

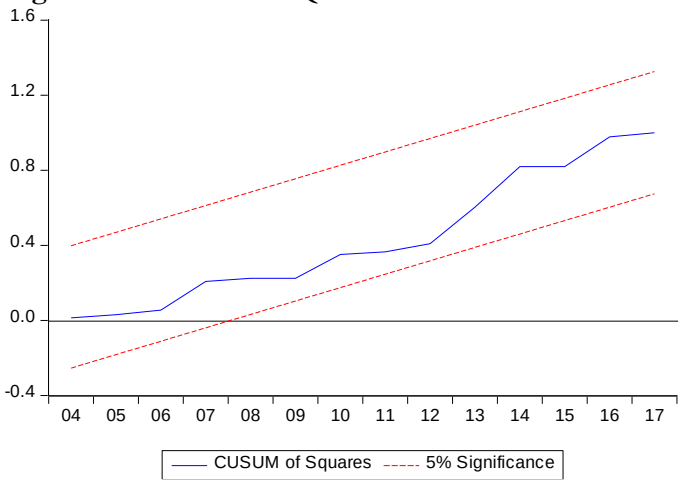


Figure 2: Dynamic Multiplier Graph.

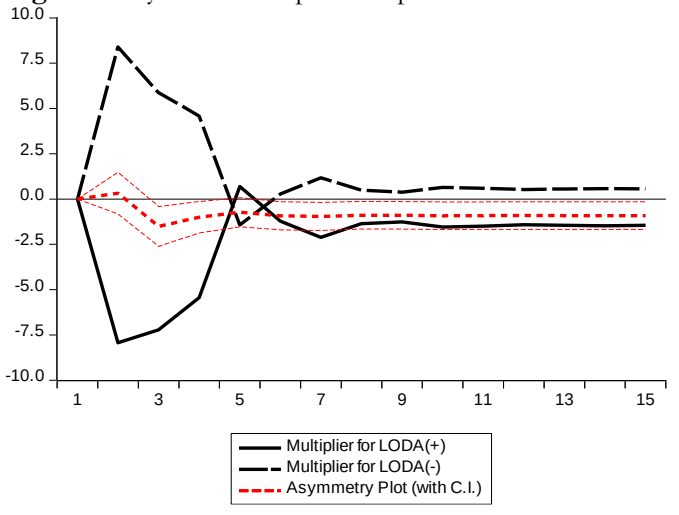


Table 7 & 8 reveal the outcomes of the interaction effect of official development assistance and political stability. The results found that individual political stability and stability jointly are insignificant both in the long and short run periods. That means that official development effect agriculture growth; it does not matter whether the system is democratic or a dictatorship way of government in Pakistan.

Table 7: *Nonlinear ARDL Estimation and Diagnostic Test Results(With Interaction Term PS) Long run Estimation.*

Variables	Coefficient	p-value
LODA_POS	-4.456627	(0.706)
LODA_NEG	-3.749980	(0.1357)
LINF	-0.247283	(0.2024)
LPOPG	-4.261238	(0.2930)
LPS	-1.192653	(0.1351)
LODA*LPS	2.328668	(0.0848)
C	6.434400	(0.1718)

Note: *, **, and *** shows 1%, 5% and 10% significance level; () are p-values.

Table 8: *Nonlinear ARDL Estimation and Diagnostic Test Results(With Interaction Term PS) Short Run Estimation*

Variables	Coefficient	p-value
C	18.76398	(0.1164)
LGAGS(-1)*	-2.916197	(0.0004)
LODA_POS**	-12.99640	(0.1179)
LODA_NEG**	-10.93568	(0.1902)
LINK**	-0.721126	(0.2139)
LPG**	-12.42661	(0.2411)
LPS**	-3.478011	(0.1841)
LODA*LPS**	6.790854	(0.1401)
D(LGAGS(-1))	1.398098	(0.0304)
D(LGAGS(-2))	0.928585	(0.0537)
ECT	-2.916197	(0.0004)
R^2	0.866524	
Adj. R^2	0.852447	
F-Stat	2.768129	(0.051637)
LM Test	0.004240	(0.9481)
J.B Test	0.371453	(0.830501
Hetro Test	11.37596	(0.2508)
CUSTOM	S	
CUSUMSQ	S	

Note: *, **, and *** shows 1%, 5% and 10% significance level; () are p-values.

Figure 5A: Plot CUSUM.

Figure 6A: Plot CUSUMQ.

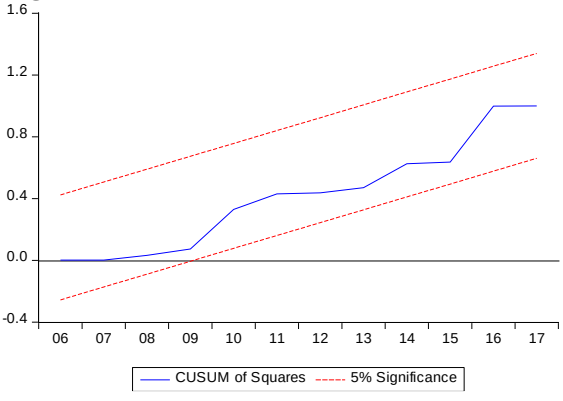
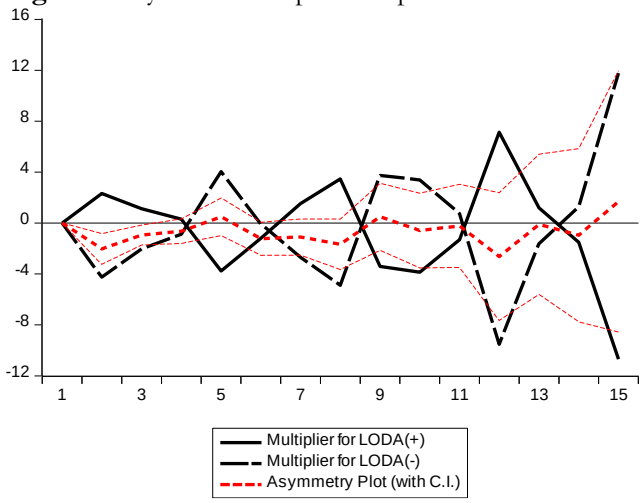


Figure 3: Dynamic Multiplier Graph.



Conclusion and Policy Recommendations

We analyze the impact of official development assistance on agriculture sector growth from 1985–2019 in Pakistan with the help of nonlinear ARDL models to find the results. The nonlinear ARDL results specify an asymmetric behavior of official development assistance on agriculture sector growth. The results found an adversely effect of official development assistance on agriculture growth in Pakistan. The study also tested how ODA and the agro-growth link were affected by two governance indicators; corruption and political stability. The interaction impact corruption has a considerable positive influence on agricultural growth in both the long and short run. The interaction effect of political stability on agriculture growth is insignificant in the long and short run. These results indicate an eye-opening fact for the country. Firstly, only foreign aid did not prove beneficial without achieving governance level. Secondly, if Pakistan wants to attain fruitful and impressive results from official development assistance for agriculture growth, the country must control or decrease the level of corruption. In Pakistan, the inflation rate and population growth are less important determinants of agricultural growth. In that case, there need a skilled labor and improved technology. Suggestions for researchers, policymakers, and government officials are that without controlling corruption, Pakistan's investment through foreign aid capital in agriculture growth is just a waste of resources. Secondly, suppose a country wants to become self-sufficient in the agriculture sector, it should divert from the traditional production method to a modernized method of producing agricultural products and increase skilled labor to enhance agriculture output. Recommendations for future research may be possible in neighboring countries with more relevant determinants.

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