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Research Article

Agriculture and Economic Growth: Evidence from Pakistan

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ABSTRACT:
The overarching objective of this study is to make vigorous endeavor to examine the contribution of agriculture sector towards GDP growth rates in Pakistan over the period 1971-2015.Using ARDL approach to co-integration, the empirical results indicate that agriculture sector has significant influence on GDP growth rates of Pakistan. The long-run and short-run coefficients of agriculture are estimated to be 0.31 and 0.27 respectively. Agriculture sector has been playing an important role to enhance economic growth of Pakistan. Therefore, our findings recommended that the Government of Pakistan may introduce novel modern technologies such as mechanization for the improvement of agriculture sector which bring some structural changes and ensure agriculture leading economic growth of Pakistan.

Keywords: Agriculture, GDP growth rates, ARDL, Pakistan

[I] INTRODUCTION

Agricultural is an important sector of Pakistan's Economy. This sector directly supports the country's population and accounts 20 % in gross domestic product (GDP), 43.5 % of labour force engaged with agriculture sector [1].In Pakistan, almost 68 % of population lives in rural areas and engaged in agricultural activities. The growth of agriculture sector has fluctuated over the period of 45 years. In the 1970' the growth rate 2.4%, which was the lowest growth rate recorded due to structural problems. After in the decade of 1980's the growth rate was 5.4% which was greatly increased due to Green Revolution being at its peak in a decade span.

During 1990's growth rate was declined at 4.4 percent. On the other hand, in the 2000's onwards growth of agriculture sector continuously declined from 3.2% in 2000's to -2.2% in the year of 2000-01, 0.1% in 2001-02, 4.1 in 2002-03.However, in the year of 2003-04 growth was 2.4% which was decline due to pest attack and due to wide spread rain which was badly affected on production of cotton crop. Later in the year of 2004-05 and 2005-06 growth of agriculture was impressive increased at 6.5% and 6.3% due to timely availability of water, fertilizer and supply of credit to the farming communities.

Recently, the overall performance of agriculture sector has lost significantly growth rate slowed to 3.4% during 2006-07,1.8% in 2007-08,3.5% in 2008-09,0.2% in the year 2009-10,2.0% in 20010-11, 3.6% during 2011-12, 2.9% in 2012-13, 2.7% in the year 2013-14 and 2.9% in the year 2014-15 as given in Table1[1].

Table 1: Agriculture Sector Growth rate

Years	Growth in (%)	Years	Growth in(%)
1970s	2.4	2006-07	3.4
1980s	5.4	2007-08	1.8
1990s	4.4	2008-09	3.5
2000s	3.2	2009-10	0.2
2000-01	-2.2	2010-11	2.0
2001-02	0.1	2011-12	3.6
2002-03	4.1	2012-13	2.9
2003-04	2.4	2013-14	2.7
2004-05	6.5	2014-15	2.9
2005-06	6.3	-	-

Source: Economic Survey(Statistical Supliment,2014-15)

1.1. Performance of Agricultural Sub-sectors:

Agriculture sector is based on its five sub-sectors includescrops, livestock, fishery and forestry. The major agricultural crops are wheat, rice,cotton, sugarcane, fruits and vegetables [2].The irrigation system of Pakistan belongs to one of the world's largest system to support agricultural production. There are two main seasons of crop production in Pakistan including cotton, rice and sugarcane starts in May and harvest until November. Wheat crop extends from November to April. Key urgent need to improve agricultural production is to make more effectual use of resources, mainly land and water [3].During the FY 2014-15, the overall performance of major crops growth was 8.0 % in the year of 2013-14 which was declined at 0.3% thereafter in the year of 2014-15.While, major crops contributes 5.3% to the GDP and 25.6% value added in in agriculture. On the other hand, growth of minor crops was increased at 1.1 % in the year of 2014-15 as compared to negative growth 5.4 % last year. Minor crops accounts 11.1% value addition to the agriculture and 2.3% towards GDP. The growth of livestock was greatly increased at 4.1 % in the period of 2014-15 as compared to 2.8 % in the year of 2013-14. However, livestock 56.3% value added to the agriculture sector and 11.8% to the GDP in the year of 2014-15. Moreover, fishery and forestry growth were substantially increased in the year of 2014-15 at 3.2 % and 5.8 % as compared to 1.0 % and -6.7 % thereafter year of 2013-14 respectively[4].In Pakistan, agricultural growth rate was low as compared to developed countries due to several challenges includes soil erosion, shortage of water, lack of modern technologies; less availability of credit, under developed infrastructure facilities, poor agricultural marketing and rising prices of major agricultural inputs[5,6 and 7].The economic growth of Pakistan mostly depends on agriculture sector. Therefore, agricultural growth can be increase due to use of inputs such as land, water, improved seed variety, pesticide, consumption of fertilizer and latest modern technologies to rise the agricultural productivity[8 and 9].

1.2.Objective of the study

The main purpose of thisresearch is to investigate the role of agriculture sector ineconomic growth of Pakistan.

[II]LITERATURE REVIEW

A few studies have been done regarding the growth of agriculture sector and its performance over the years in Pakistan. According to Zaidi [10] observed that the trend of agriculture sector growth in Pakistan and he found out that the development and growth of this sector is depend on the government policies and political scenario in Pakistan. A study by Katircioglu[11] tried to explore the influence of agricultural sector on the economy of North Cyprus by using time series data over the period 1975 to 2002. Johansen co integration test and Granger test was used in order to determine agricultural output growth and

economic growth as measured by GDP growth were stationary at naturally co integrated. They were in long run association. The researcher found out that agriculture sector has positive influence in North Cyprus of economic growth.

Another Study by Subramanian et al, [12] tried to explore by applied a Vector Error-Correction Model (VECM) to showed that incorporates among the agriculture sector, services sector, manufacturing sector and trade sector. This method was employed to estimate whether the existence of long-run and short-run relationships between these sectors. The results of study showed that these sectors in the Poland and Romanian economies moved together over the sample period. A study in Nigeria by Anthony [13]examined thatthe impact of agriculture credit on economic growth of Nigeria. The researcher specified a functional and operational form, and established a causal relationship among gross domestic product (GDP) and agricultural variables. The results of their study indicate that agricultural variables have significant and positive impact on economic growth of Nigeria. Qazi et al,[2]have investigated that the role of agricultural product prices and government expenditure in the determination of agricultural performance in Pakistan. The researchers was applied Dickey Fuller Generalized Least Square (DF-GLS) test in order to check the stationary of the series to examine the level of integration and ARDL approach was also applied. The empirical results of their study showed that in the long-run agricultural prices and the government expenditures on agriculture sector have positive impact on agricultural performance in Pakistan. A study in Bangladesh by MostafizurRahman, et al, [14]investigated the causal relationship between GDP, agricultural, industrial and services sector growth for Bangladesh by using secondary data over the period of 1972 to 2008. The granger causality/ block exogeniety Wald test statistic was used in order to determine casual association between these sectors. The study revealed that the existence of long run relationship among these sectors. Furthermore, empirical results showed that agricultural and industrial sector are the influencing factor on the GDP of Bangladesh but service sector is not influence to the GDP of Bangladesh.

Another study by Hinaet al,[15] tried to find out the impact of agriculture volatility on economic growth of Pakistan by using annual time series data from 1972 to 2011.Theunit root ADF test was used to check the stationary of the series. While Johansen co- integration test was employed in order to estimate the existence of the long-run associationbetween these series. The study revealed that employment in agriculture sector and agriculture productivity has significant impact on economic growth of Pakistan.

According to Anwar et al, [16]investigated the role of agriculture sector share in Gross Domestic Product (GDP) of Pakistan by using secondary data. An econometric technique, OLSmethod was used to analyze the data. The results of study revealed that agriculture sector has positive influence on GDP of Pakistan.

Meanwhile, Suleiman and Aminu[17]have investigated that the influence of agriculture sector, petroleum sector and manufacturing sector to the GDP of Nigeria. However, researchers found out that agriculture sector contribute greatly to the GDP of Nigeria as compared to petroleum sector and manufacturing sector. Furthermore, the empirical results showed that agriculture contributes 1.7978 units to the GDP. Whereas petroleum sector contributes 1.14 units towards gross domestic product (GDP) which was low as compared to the contribution of agriculture sector.

The study by Raza et al. [18]examined that the performance of agriculture sector and economic growth of Pakistan. The results showed that there was significant role of agricultural sub-sectors to the economic growth but the role of forestry had non-significant in economic growth.

Another study by, Nazish et al,[19]investigate that effect of economic sectors towards GDP growth of Pakistan. The researchers used time series data and a multivariate co integration method was used.

The results of their study showed that economic sectors were positively impact on GDP growth of Pakistan. Meanwhile, Zaheer[20]have explored the performance of agriculture sector in Pakistan by using secondary dataover the period of 1952-2010.The results of their study showed that the growth rate of agriculture sector was fluctuated over the period of sixty (60) years. From these reviews, we found that agriculture sector is prime source of Pakistan's economy. Therefore, it is always interesting for researchers to examine the relationship between agriculture and economic growth for any country.

[III] MATERIALS AND METHODS

3.1. Methodology Framework and Data Source

The present study is designed for the period of 45 years accounting from 1971 to 2015. The annual time series data is used in this study. Data is obtained from the Economic survey of Pakistan (various publications) and Pakistan Statistical Year Books. Thegoal of this research is to estimate the long-run relationship among agriculture sector and GDP growth rates of Pakistan. The variables are calculated as follows:

GDPR= Real Gross Domestic Product growth rate
AGRI= Agriculture sector growth rate
MANUF= Manufacturing sector growth rate
SERVS= Service sector growth rate

3.2. Unit Root Test Estimation

In the current study we have used the popular ADF test [21 and 22]to check the stationary of the series and AIC [23]is employed to select the optimum ADF lag. However, ADF test is used to check the stationary of the data on their level and 1st difference including intercept and trend. The equation of this case is given as

$$\Delta Y_t = \alpha + \beta Y_{t-1} + t + \Sigma_i \beta_2 \Delta Y_{t-k} + \mu_t \ldots\ldots(1)$$

Where,

Y_t Denote for time period

ΔDenote for first difference operator

t Stand for linear trend

αDenote for constant of coefficient

μ Denote for error term

3.3. Autoregressive Distributed Lag Method to Co-integration (ARDL) Analysis

The ARDLbounds of co-integration areproposedby Pesaran et al[24].However,Autoregressive Distributed Lag technique is consisted of two cases for investigating long run relationship. The First case is to estimate the existence of long run association between all variables.

We have specified the model to estimate long-run association following equation is as bellow:

$$\begin{aligned}\Delta(GDPR)_t = \beta_0 &+ \sum_{i=0}^{k} \beta_{1i}\, \Delta(AGRI)_{t-i} \\ &+ \sum_{i=0}^{k} \beta_{2i}\, \Delta(MANUF)_{t-i} \\ &+ \sum_{i=0}^{k} \beta_{3i}\, \Delta(SERV)_{t-i} \\ &+ \beta_4 (GDPR)_{t-1} + \beta_5 (AGRI)_{t-1} \\ &+ \beta_6 (MANUF)_{t-1} \\ &+ \beta_7 (SERV)_{t-1} + \upsilon_t \ldots\ldots(2)\end{aligned}$$

Where, υt stand for white noise term and Δstand for the 1st difference operator term. This empirical model would examine the relationship of agriculture sector between GDP growth rates of Pakistan. Gross Domestic Product Growth rates (GDPR) is used as dependent variable and there are three explanatory variables (Agriculture sector, Manufacturing sector and Services Sector) are used as independent variables. However, an appropriate Schwarz Bayesian Criterion (SBC) lags are selected. The Wald test (F-statistics) or bounds testing method is established on the combined F-statistic that is tested the null hypothesis of no co-integration, $H_0 : \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$ against its the alternative of co-integration hypothesis $H_1 : \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$ .Howeve r, the results of this (F-statistics) test is subnormal, in spite of these variables are I (0) or

(1). Whereas, the results of the long run relationship can be interpreted is as follows. If the estimated F-statistic lies above the upper level of the bound, the null hypothesis is rejected which showing a relationship among the variables. If the estimated F-statistics is higher than upper bound value, we cannot reject the null hypothesis of no integration exists. Now the second case isto estimate the effects of three independent variables on GDP growth rates of Pakistan in case of long-run and short-run, in order to determine we have to analyze the modelsthat are represented in Equations (3) and (4) .TheARDL model for estimate the long run coefficient is as given bellow:

$$GDPR_t = \eta_0 + \sum_{i=0}^{k} \eta_{1i}(AGRI)_{t-i} + \sum_{i=0}^{k} \eta_{2i}(MANUF)_{t-i} + \sum_{i=0}^{k} \eta_{3i}(SERV)_{t-i} + \varepsilon_{t \ldots (3)}$$

Now we have to examine the short run coefficient of the model with error correction term. The ECM model is applied to find the short run relationship among the GDP growth rate and other three explanatory variables. However, the value of ECM coefficient has to be negative and significant that showing the how far we are from the long run equilibrium that will indicate the short run equilibrium between the variables. The short run error correction model (ECM) is given bellow:

$$\Delta GDPR_t = \alpha_0 + \sum_{i=0}^{k} \alpha_{1i}\,\Delta(GDPR)_{t-i} + \sum_{i=0}^{k} \alpha_{2i}\,\Delta(AGRI)_{t-i} + \sum_{i=0}^{k} \alpha_{3i}\,\Delta(MANUF)_{t-i} + \sum_{i=0}^{k} \alpha_{4i}\Delta(SERV)_{t-i} + \lambda(CEM)_{t-i} + \varepsilon_t \ldots\ldots(4)$$

[IV] RESULTS AND DISCUSSION

4.1. Results of ADF Test

The results of popular ADF test are reported in table-2.The ADF testis used to check the stationary of the data including both trend and intercept. Whereas, which variable is non-stationary at their level then again made stationary after taking 1st difference and 2nd difference denoted by I (1) and I (2).The results of ADF test for stationary of the data including trend and intercept indicate that GDPR and AGRI are stationary at their level but MANUF and SERVS variables are not stationary at their level. We again made stationary of the data after taking at their first difference including with trend and intercept. However, the results of test show that all variables are stationary at their 1st difference at 5% of significant level.In Table-3 the results of the bounds co-integration test indicate that the null hypothesis of non-co-integration could be rejected at 1% and 5%of significance level. The calculatedF-statistics of 5.61 is higher than the critical value 4.29 of the lower level of the bound which is proof of long-run relationship between GDP growth rates, agriculture sector, manufacturing sector and serveries sector growth rates.

Note: C denote for Constant, T stand for Trend and K represent optimum lags selected using the maximum AIC value

Table 2: ADF unit root test results for statioarity including both trend and intercept

Variables	Level				First Difference			
	Test (C.T.K)	Test Statistic	5%Critical Value	Prob	Test (C.T.K)	Test Statistic	5%Critical Value	Prob
GDPR	(C.T.0)	-5.123240	-3.515523	0.0000	(C.T.1)	-6.614122	-3.520787	0.0000
AGRI	(C.T.0)	-8.377166	-3.515523	0.0000	(C.T.9)	-4.389845	-3.548490	0.0072
MANUF	(C.T.5)	-2.975249	-3.529758	0.1518	(C.T.4)	-4.335521	-3.529758	0.0073
SERVS	(C.T.7)	-2.768993	-3.536601	0.2171	(C.T.6)	-4.262278	-3.536601	0.0092

Table 3: Result of Bounds test for co- integration

Critical Value Bounds	**F- statistics**	**7.36**
	Lower bound	Upper bound
1%	4.29	5.61
5%	3.23	4.35
10%	2.72	3.77

Note: Critical values are obtained from Pesaran et al. (2001)

In Table 4 the results of long run coefficient using the ARDL approach indicate that agriculture sector has a significant influence on GDP growth rates. Regarding the empirical results, agriculture sector makes a significant share to the GDP growth rate in the long-run. The role of agriculture's such as to provide food, generate jobs opportunity and export earnings. However, this sector is an important foundation of boosting economic growth in Pakistan.

By contrast, agriculture sector is a most important sector than manufacturing sector and service sector. This sector is source of employment for the people of Pakistan. At most 63% of population directly and indirectly engaged in agricultural activities. However, the estimated agriculture parameter is significant at 1% probability level. The value of coefficient of agriculture sector is 0.31809; which means one unit increase in agriculture growth rateGDP growth rate will increaseat 0.31units. Furthermore, the coefficient value of manufacturing sector is 0.35602 which indicates that one unit increase in growth rate GDP growth rate will increase by 0.35 units. While, the value of coefficient of services sector is 0.11906 which means one unit increase in growth rate leads to increase GDPat 0.11 units. Our empirical results stay in line with [25, 26 and 27].Furthermore, our results in this research study are reversed with theresults observed in the previous studies like as [16, 17 and 18].

In past, most of these studies were used Ordinary Least Square (OLS) method but in this current study we have applied ARDL approach to investigate the long run and short run relationship in the model with anticipated variables. The value of R2 is 0.88 which showed that 88% total variation in the gross domestic product (GDP) was explained by these three independent variables.

Table: 4 Represents Results of Long-run Coefficients of Using ARDL Approach

ARLD (1,0,0,0) selected based on Schwarz Bayesian Criterion, 1972 to 2015

Regressors	**Coefficient**	**Standard error**	**T ratio**	**[Prob]**
AGRI	.31809	.050094	6.3499	[.000]
MANUF	.35602	.040041	8.8913	[.000]
SERVS	.11906	.046327	2.5699	[.014]
C	1.0543	.42227	2.4967	[.017]
R-squared	.88143	R-Bar-squared	.86927	
DW-statistics	1.8756	F-stat. F(4,39)	72.483	.000

Diagnostic Tests

Test Statistics *	**LM version** *	**F Version** *
*A: Serial Correlation *CHSQ(1)	= .21702[.641]*	F(1,38)= .18835[.667]*
*B: Functional Form *CHSQ(1)	= .0012768[.971]*	F(1,38)= .0011027[.974]*
*C: Normality CHSQ(2)	= .2.6456[.266]	* Not applicable *
*D: Heteroskedasticity*CHSQ(1)	= .012096[.912]*	F(1.42)= .011550[.915]*

Note: Author's calculations using Microfit 5.01

Table: 5 Presents the Results of Short-run Coefficients of Using ARDL Approach

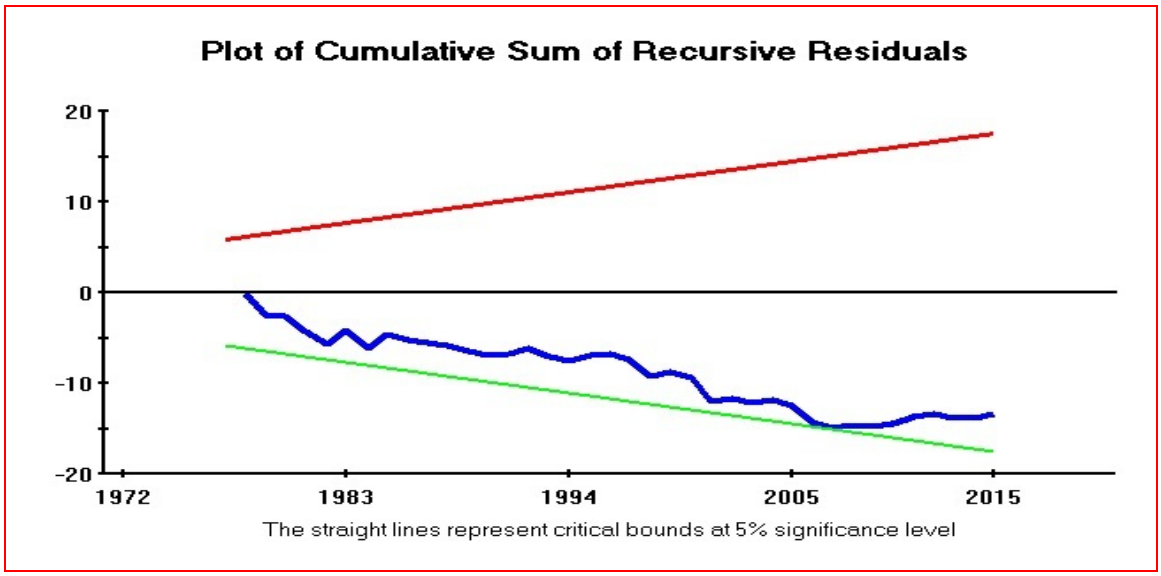
ARLD (1,0,0,0) selected based on Schwarz Bayesian Criterion, 1972 to 2015

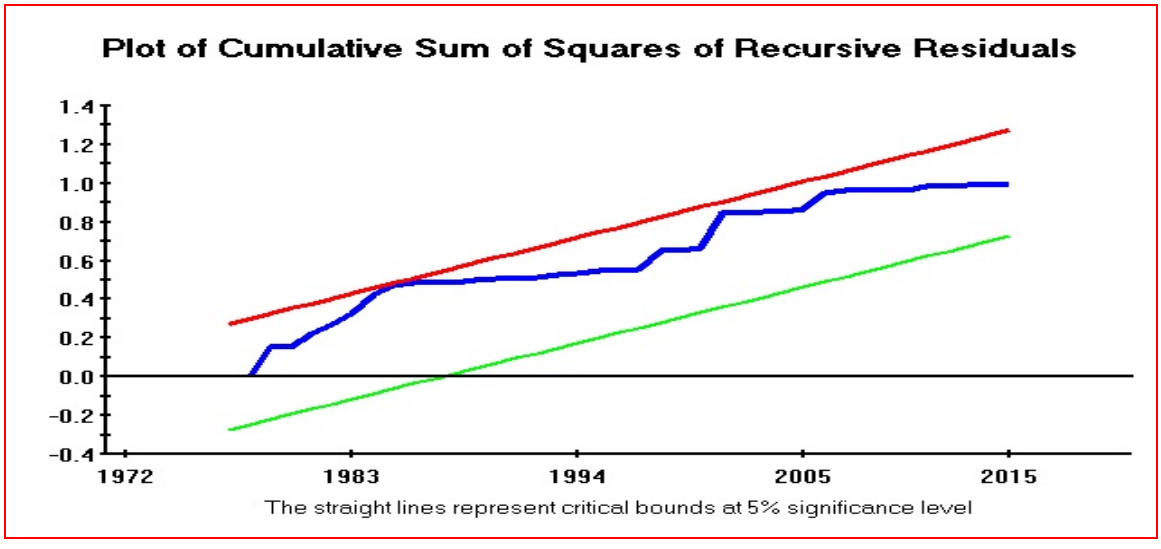
Regressors	Coefficient	Standard error	T ratio	[Prob]
DAGRI	.27815	.037879	7.3431	[0.000]
DMANUF	.31131	.033827	9.2031	[0.000]
DSERVS	.10411	.040479	2.5719	[0.014]
Ecm(-1)	-.87443	.065215	-13.4085	[0.000]

ecm=GDPR -.31809*AGRI -.35602*MANUF -.11906*SERV -1.0543*C

Note: Author's calculations using Microfit 5.01

The results of short run coefficient of ECM are represented in table 5. The coefficient value of Ecmt-1(-0.87) is significant and also negative sign which is showing long-run relationship exists[28].ECM shows that deviation from the long-run equilibrium is modified about 87% each year at 1% level of significance. While we also checked the stability test through the plot of CUSUMQ and CUSUM.The results of CUSUMQ and CUSUM in figures 2 and 3show that test statistics are within 5% significant interval bound. In our study ARDL model, long-run and short-run estimates are stable from the period of 1971 to 2015.





[V] CONCLUSION AND SUGGESTIONS

This study examined the relationship of agriculture sector growth rateand GDP growth rate of Pakistan by using the ARDL model. The empirical results showthat long-run and short-run coefficients of agriculture sector are estimated to be 0.31 and 0.27 respectively which makes highly significant effect on GDP growth rate of Pakistan. This sector is a prime sector of Pakistan's economy as compared with other sectors. Therefore, our findings recommend that the Government of Pakistan may introduce novel modern technologies such as mechanization for the improvement of agriculture sector which bring some structural changes and ensure agriculture leading economic growth in Pakistan.

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