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RELATIONSHIP BETWEEN AGRICULTURE AND GDP GROWTH RATES IN PAKISTAN: AN ECONOMETRIC ANALYSIS (1961-2007)

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ABSTRACT

The present study has been conducted in the year 2008 to make econometric analysis of the relationship between agriculture growth rate and GDP growth rate in Pakistan. Time series data ranging from 1961 to 2007 on the above variables has been taken from Economic Survey of Pakistan (Statistical Supplement, 2006-07) and Federal Bureau of Statistics (1998). Augmented Dickey Fuller (ADF) test has been used for checking the stationarity of the data. The Akaike Information Criterion (AIC) has been used to select the optimum ADF lag. Furthermore, the Johenson Co-integration test (Likelihood Ratio statistic) has been used to detect the long-term relationship among the series. The method of Ordinary Least Square has been used to show the contribution of agriculture growth rate towards GDP growth rate. The results revealed that 1% increase in the agriculture growth rate brings 0.34% increase in GDP growth rate. The explanatory variable (agriculture growth rate) is statistically significant at both 1% and 5% level of significance. It is recommended that the government should stimulate GDP growth rate through agriculture growth in the Pakistan.

***Key words**: Relationship; agriculture; GDP growth rate; econometric analysis*

INTRODUCTION

To study the role of agriculture in the process of economic growth is of crucial important. In Pakistan, agriculture sector contribution towards GDP is 24% in 2005-06, which the largest as compared to all other sectors in the economy (Economic Survey of Pakistan, 2005-06). Further, this sector has not only absorbed lot of labor force but also is a big source of industrial growth in Pakistan. In Pakistan, the GDP growth rate was 6.6% while that of agriculture growth rate was 1.6% in the year 2005-06. In 2006-07, the GDP growth rate has been increased to 7% while that of agriculture growth rate has also been increased to 5% (at constant factor cost), (Statistical Supplement, 2006-07).

The overall development of a country depends upon the health of agriculture sector, because provides food, raw materials, and also to earn foreign exchange which further push industrialization in the country (Johnston, 1970). According to Gardner (2005), in some countries there is no significant evidence of agriculture leading overall economic growth. But Tiffin and Irz (2006) found that there are sufficient evidences which supports the conclusion that agricultural is the main cause variable of overall growth rate. Timmer (2005) correlated poverty with growth in agricultural output and concluded that at the provincial level roughly two-thirds of the reduction in poverty was due to growth in agricultural output.

The present study is different from all of the above studies conducted as it assess the relationship between agriculture growth rate and GDP growth rate in Pakistan during 1961-2007, using econometric techniques.

MATERIALS AND METHODS

The present study has been conducted in the year 2008 to show relationship between agriculture growth rate and GDP growth rate in Pakistan using econometric techniques. Time series data ranging from 1961 to 2007 on the above variables has been taken from Economic Survey of Pakistan (Statistical Supplement, 2006-07) and Federal Bureau of Statistics (1998). Augmented Dickey Fuller (ADF) test has been used for checking the stationarity of the data. The Akaike Information Criterion (AIC) has been used to select the optimum ADF lag. Variables, which were non-stationary at level, have been made stationary after taking first difference and second difference. Furthermore, the Johenson Co-integration test has been used to detect the long-term relationship among the series. To this end, the Likelihood Ratio (LR) statistic is used.

To show the contribution of agriculture growth rate towards GDP growth rate, the method of Ordinary Least Square method has been used and the following model was estimated inducting agriculture growth rate as explanatory variable while GDP growth rate as dependent variable.

$GDPR = b_o + b_1 AGR$ ----------(1)

Where, GDPR = GDP Growth Rate (%) at factor cost in Pakistan

AGR = Agriculture Growth Rate (%) at factor cost in Pakistan

The problem of autocorrelation has been solved by using Durbin two-step methods. At first step, the following model was estimated to find out the value of $\hat{\rho}$ (i.e. coefficient of $GDPR_{-1}$, which is b_1 here).

$GDPR = b_o + b_1 GDPR_{-1} + b_2 AGR + b_3 AGR_{-1}$ ----------(2)

At second step, GDPR* has been regressed on AGR*

Where

$GDPR^* = GDPR - \hat{\rho}\, GDPR_{-1}$

$AGR^* = AGR - \hat{\rho}\, AGR_{-1}$

A statistical package Eview has been used for deriving the results.

RESULTS AND DISCUSSION

The ADF test results have been presented in Table I and II. In Table I, the stationarity of the data has been checked including no intercept and no trend while both intercept and trend have been included in Table II. Variables which are not stationary at level have been made stationary after taking the first difference denoted by I(1) and then the second difference i.e. I(2) if needed. The values given in the brackets are the optimum lags selected on the basis of AIC criterion (i.e the lag t which the AIC value is minimum). According to Table I, both the variables i.e. AGR and GDPR are stationary at level. The results of stationarity are given in Table II, when both intercept and trend are included. Again AGR and GDPR are stationary at level.

Table 1. ADF test results for stationarity (including no intercept and not trend)

Variable	I(0)		I(1)		Results
	Test Statistic	Critical value	Test Statistic	Critical value	
AGR	-8.9442 [0][1]	-3.58			I(0)
GDPR	-5.3642 [0]	-3.58			I(0)

(1) Figures in square brackets besides each statistics represent optimum lags, selected using the minimum AIC value.

Table-II: ADF test results for stationarity (including both intercept and trend)

Variable	I(0)		I(1)		Results
	Test Statistic	Critical value	Test Statistic	Critical value	
AGR	-8.898 [0][2]	-4.168			I(0)
GDPR	-5.4632[0]	-4.168			I(0)

(2) Figures in square brackets besides each statistics represent optimum lags, selected using the minimum AIC value.

Furthermore, the regression results may be spurious due to no co-integration among the series. To this end, the Jhonson Co-integration test has been used. The likelihood ratios statistic values are given in Table III (including no trend and no intercept) and in Table IV (including both intercept and trend), which indicates the long-term relationship among the variables of the study and rejects the hypothesis of no co-integration. Because the absolute values of the LR ratios are greater than their relevant critical values which indicates the existence of one co-integrating equation at 5 percent in the former case and two co-integrating equation at 5 percent in the later case.

Table III Johanson Co-integration test results including no intercept and no trend

Series: AGR GDPR				
Lags interval: 1 to 1				
	Likelihood	5 Percent	1 Percent	Hypothesized
Eigenvalue	Ratio	Critical Value	Critical Value	No. of CE(s)
0.417167	25.55841	12.53	16.31	None **
0.027719	1.264987	3.84	6.51	At most 1

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Table IV Johanson Co-integration test results including both intercept and trend

Series: AGR GDPR				
Lags interval: 1 to 1				
	Likelihood	5 Percent	1 Percent	Hypothesized
Eigenvalue	Ratio	Critical Value	Critical Value	No. of CE(s)
0.437906	43.85011	25.32	30.45	None **
0.328580	17.92623	12.25	16.26	At most 1 **

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

L.R. test indicates 2 cointegrating equation(s) at 5% significance level

Regression results with AGR as an independent variable, are given in Table V. The results indicate that 1% increase in the agriculture growth rate brings 0.34% increase in GDP growth rate. The coefficients are statistically significant at both 1% and 5% level of significance as indicated by low values of 'P' in Table V. The high value of R-square (0.81) suggests that the fit is good and the

included explanatory variable (agriculture growth rate) is responsible factor for changes in GDP growth rate.

Durbin-Watson value (1.24) suggests positive serial autocorrelation. To take away the autocorrelation, Durbin-two step method is estimated. The results of Durbin-two step method are given in Tables VI and VII. In the first step, the estimated value of $\hat{\rho}$ is 0.382868. In the second step, putting this value in the transformed model, gave the Durbin-Watson value equal to 1.88, which is closer to 2 showing no problem of autocorrelation.

Table V Regression results of relationship between AGR and GDPR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.274589	0.382887	11.16411	0.0000
AGR	0.335278	0.074030	4.528924	0.0000
R-squared	0.813094	Adjusted R-squared		0.827829
Durbin-Watson stat	1.241905	Prob(F-statistic)		0.00043

Table VI Regression results applying Durbin first step

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.231305	0.805092	2.771492	0.0083
GDPR(-1)	0.382868	0.141795	2.700152	0.0099
AGR	0.370712	0.073613	5.035950	0.0000
AGR(-1)	-0.050540	0.086364	-0.585202	0.5615
Durbin-Watson stat	1.831907	Prob(F-statistic)		0.000030

Table VII Regression results applying Durbin second step

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.676027	0.283003	9.455831	0.0000
AGR*	0.325676	0.059545	5.469447	0.0000
Durbin-Watson stat	1.881992	Prob(F-statistic)		0.000002

CONCLUSION AND RECOMMENDATIONS

From the facts and figures it is clear that agriculture growth rate and GDP growth rate are positively correlated. One percent increase in the agriculture growth rate brings 0.34% increase in GDP growth rate. The explanatory variable (agriculture growth rate) is statistically significant at both 1% and 5% level of significance and reveals that the included explanatory variable is mostly responsible for variation in the response variable (GDP growth rate). Based on findings of the study, it is recommended that the government should make structural changes in agriculture sector so as to ensure agriculture leading overall economic growth in the Pakistan.

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