Global Climate Change and Its Impact on Agriculture Sector in Pakistan

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ABSTRACT

Impact of global climate change on the agriculture sector of Pakistan is estimated in Pakistan. Agriculture is considered as the backbone of Pakistan economy because more 60% population is directly involved with this profession. Due to rapid industrialization the temperature level is increasing, which is harmful for agriculture crops and also for people. The objective of this research paper is to explore the impact of the global warming at agriculture sector of Pakistan and to measure climate impact on the agriculture sector in future. Times series dataset from 1974 to 2013 is used to analyze the impact. Agriculture value added annual growth rate is used as dependent variable. Carbon oxide emission, agriculture methane emission, agriculture nitrous oxide emission, greenhouse gas emission and population density are used as explanatory variables. Auto regressive distributed lag model is used as statistical technique to analyze the dataset. The result shows that the variables have significant impact on the agriculture sector of Pakistan. Auto regressive distributed lag model presents the existence of the short run and long run relationship between the dependent and independent variables. In a policy recommendation government try to reduce the warming through control on industrialization.

Keywords: CO_2, Climate change, Agriculture productivity, ARDL

INTRODUCTION

Environmental change is measure by the different kind of gasses into the air. These gasses gather in the atmosphere, which result an unnatural climate change. The movements in overall air related parameters, for instance, temperature, precipitation, soil dampness and sea level. Nonetheless, the faithful nature of the conclusion on ecological change is vague. There are no hard facts about what will be the outcome of additions in the centralization of the different gasses inside nature and no firm timescales are known. Agriculture business is one territory, which is basic to consider similarly as natural change. The cultivating part both adds to natural change, and furthermore will be affected by the evolving atmosphere.

Agricultural facilities contribute to approximately 20% of the annual increase in anthropogenic emissions of greenhouse gases. This sector contributes to global warming due to emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Greenhouse gases allow the transmission of light reaching the ground; they block the transfer of heat, trying to escape from the atmosphere, thus catching heat, as in a greenhouse. CH_4 has the highest global warming potential, which is approximately 300 times greater than the CO_2 potential and about 20 times greater than N_2O. The main sources of gases are nitrogen fertilizers, flooded rice fields, soil management, land conversion, biomass burning and livestock production and associated manure management. The share of the livestock sector is from 5% to 10% of the total contribution to global warming.

Climate change and agriculture in Pakistan

It is important for a nation to make its farming part proficient to upgrade sustenance security, personal satisfaction and to advance fast monetary development. The proof frame slightest created nations (LDCs) demonstrates that farming division represents an expansive partake in their GDP (Gross domestic product). In this manner the advancement of the economy can't be accomplished without enhancing the agriculture area. As per the Monetary review of Pakistan (2011-12) its fundamental regular asset is arable land and farming area's commitment to the Gross domestic product is 21 percent. The agriculture sector ingests 45 percent of work drive and it's partake in fares is 18 %. Given the part of agriculture area in monetary development and its affectability to change in precipitation and temperature it is vital to think about the effect of environmental transform on significant harvests into Pakistan.

There are two harvests periods in Pakistan specifically, Kharif and Rabi. Rabi products are become regularly in the months of November to April and Kharif yields are developed from May to October these two seasons make Pakistan a farming country and its execution relies on upon the atmosphere amid entire year. Environmental transform for the most part influences agribusiness from side to side transforms in precipitation and temperature.

The agriculture part in Pakistan assumes a significant part as the salary of more than 47 percent of the population is reliant on this area. This division is under danger from environmental change. It is anticipated that temperatures will increment by 3°C by 2040 and 5°C to 6°C before this current century's over. Because of this situation, Asia can lose 50 percent of its wheat creation (MOE, 2009). Also, farming division of Pakistan is more powerless against environmental change in light of its geological area (Janjua et al, 2011). This study discloses that because of anthropogenic exercises, temperature of earth is rising and it might have negative impact on the generation of wheat. Utilizing Vector Auto Regressive (VAR) display on the yearly information from 1960 to 2009, the study did not discover noteworthy negative effect of environmental change on wheat creation in Pakistan. Be that as it may, then again, Shakoor (2011) discovered noteworthy negative effect of temperature-ascend on farming creation furthermore found the positive effect of rain fall on agribusiness generation. Investigations depended on the wheat yield and study presumed that the negative effect of temperature is more noteworthy than the positive effect of precipitation for Pakistan. The creators additionally assessed cost of bone-dry areas due to 1% increment in temperature, which came to Rs 4180 to the net income per annum.

Main Research Problem

The research problem of our study is "Global Climatic Change and its Impact on Pakistan in Agriculture Sector"

Objective of the Study

The main objectives of this study were as under:

- To study the effects of climate change on the agriculture productivity of Pakistan.
- To find out the climate change factors that have highly impact on the agriculture productivity of Pakistan.
- To analyze that how much climate change affects agriculture sector of Pakistan and prepare solid policy to get rid of climate change problem.

Significance of the study:

Study is important for following reasons:

- It will examine the economic effects of climate change on agriculture economy of Pakistan with a different approach.
- It will also show the problems arise due to this phenomenon and will explain in detail the suggestions to get rid of this situation.
- This study shows the clear picture of agriculture economic growth and climate in Pakistan.
- This study will assist the government and its officials to make policies and motivation for upcoming researchers.

LITERATURE REVIEW

Joshi et al. (2013) attempted to explore the impact of climate parameter on the cotton yields of the three districts in Marathwada, India. The objective of the study was to explore the climate parameters impact on the cotton yields of Maharashtra district. The time series data is used of the rainfall, maximum and minimum temperature relatively humidity minimum and maximum from 22 to 53 Metrological weeks. Data of the three districts for the period of 1977 to 2007 were obtained by India meteorological department, Pune obtained on CD disk. While the secondary data of area production and yield of Aurangabad, Beed and Jalna were obtained from Epitome of agricultural part I and part II. Multiple Regression Analysis, Correlation and coefficient of determination, t-test and Percentage of contribution were used as statistical techniques. It was found that the investigation of crops is totally depends on the rainfall pursued by temperature maximum and the relative moisture minimum. Result shows that the area and production both has increased in all three districts but the inconsistence of lesser yield remains same over the years.

Mohsin et al. 2011, tried to explore the impact of the climate change on agriculture, empirical evidence from the arid region. Objective of the study was to investigate the climate change impact on the agriculture of arid region. Cross sectional data was collected through the structured questionnaires from the Rawalpindi division with the help of the time series data of climate change variables attained by meteorological station. The Ricardian method was utilized to check the connections amongst atmosphere and Net Homestead Income (NHI) over the parched area. Creation of wheat product was the center subject of the study. Result demonstrates that the expansion in temperature has huge negative effect on the farming generation in bone-dry district. An expansion in income was envisioned with the ascent in precipitation. General level of negative compel of temperature is higher than positive result of the precipitation in locale. It was uncovered that 1% expansion in the temperature would prompt to loss of Rs. 4180 to the net income per annum.

Fields at el. 2016, endeavored to examine the worldwide scale environmental change, trim yields affiliation deliver with late day's warming. Changes in the worldwide generation of real yields are imperative drivers of sustenance costs; nourishment security and land utilize choices. Normal worldwide yields for these products are controlled by the execution of harvests in a huge number of fields disseminated over a scope of administration, soil and atmosphere administrations. In spite of the multifaceted nature of worldwide sustenance supply, here we demonstrate that straightforward measures of developing season temperatures and precipitation spatial midpoints in view of the areas of every harvest clarify at least 30% of year to year varieties in worldwide normal yields for the world's six most broadly developed products. For wheat, maize and grain, there is an obviously negative reaction of worldwide respects expanded temperatures. In view of these sensitivities and watched atmosphere patterns, we assess that warming since 1981 has brought about yearly joined misfortunes of these three products speaking to approximately 40 Mt or $5 billion every year, starting 2002. While these effects are little with respect to the mechanical yield increases over a similar period, the outcomes show as of now happening negative effects of atmosphere patterns on harvest yields at the worldwide scale.

Nairobi et al. (2006), tried to investigate the economic impact of climate change on the Kenyan agriculture. Objective of the study was to measure the climate change impact on the crops of agriculture in the Kenya. Cross sectional data was used on climate, soil hydrological data and the household data for a sample of 816 households. Seasonal Ricardian model was used to assess the impact of climate on net crop revenue per acre. It was found that climate affects the productivity of crops. There is a nonlinear relation between revenue and temperature and on one hand and between precipitation and revenue on the other. The results also present that the temperature section of the global warming is very important than rainfall. It was suggested that checking of the climate change and propagation of information to farmers to motivate adaptations to climate change.

Cline (2007) utilized the Ricardian factual and harvest model to build up an arrangement of accord agriculture effect gauges through the 2080s for more than 100 nations. He initially grew geologically itemized protrusions for alterations in precipitation and temperature in light of a benchmark emanation projection from the IPCC's Outflow Situations. Next, these climatic transform protuberances were connected to the agriculture effect models to evaluate the impacts of environmental change on rural efficiency. The last agreement appraisals were the weighted normal of the Ricardian gauges and the harvests demonstrate gauges.

The Ricardian time series method investigates the association ship between agriculture limit (measured via arrive esteem) and atmosphere factors (generally precipitation and temperature) on the premise of factual appraisals from farm review or nation level information. This approach naturally consolidates productive environmental change adjustments by farmers. The real reactions of the Ricardian approach are its obliviousness of value changes and that it neglects to completely control for the effect of different factors that influence cultivate livelihoods.

Karanja, M. 2006, endeavored to quantify the monetary effect of atmosphere on yields in Kenya. He utilizes cross sectional information on atmosphere, hydrological, soil information and family unit level information for a specimen of 816 families. For gauge the occasional Ricardian show for surveying the effect of atmosphere on net yield income per section of land. The outcomes demonstrate that atmosphere influences edit profitability. There is a non-straight relationship amongst temperature and income on one hand and amongst precipitation and income on the other. Evaluated negligible effects recommend that an unnatural weather change is hurtful for yield efficiency. Forecasts from worldwide course models affirm that an unnatural weather change will substantially affect net product income in Kenya. The outcomes additionally demonstrate that the temperature part of a dangerous atmospheric devotion is a great deal more critical than precipitation. Discoveries call for observing of environmental change and spread of data to farmers to urge adjustments to environmental change. Enhanced administration and protection of accessible water assets, water gathering and reusing of waste water could produce water for water system purposes particularly in the dry and semi bone dry zones.

Shakoor, et, al watched the general degree of negative effect of temperature is more prominent than the constructive outcome of precipitation in the locale. S. Edges et, Al. considered rainfed agribusiness underpins 40 percent of the Indian populace and contributes 44 percent to the national nourishment wicker container. David et al indicate essential of precipitation, which must be in adequate amount, additionally at a period and at a pace sufficient to the vegetative cycle of the plant. Kanga et, al, (2004), the amount of the stormy season is to be sure dictated by a few parameters, it span, which relies on upon the onset and suspension dates of the rainstorm, its circulation and its inconstancy. Al Bergel et, al. (1985), factual investigation demonstrates a positive connection amongst precipitation and the variety of cotton generation in Burkina faro. They discovered critical positive coefficients off relationship of 0.72 for the entire cotton zone and 0.67 for most escalated range of generation. Bella Medjo et al. [2005] as far as yield examination, precipitation in the north of Cameroon uncovered a positive and critical connection coefficient of 0.59, in the nation has yearly precipitation beneath 600mm/annum and south zone where precipitation surpasses 600mm for every annum demonstrates no huge results.

Research Methodology

Table 1: Selected variables

Variables	Description of the variables	Source
Dependent variable		
AVAG	Agriculture value added annual growth rate	Cresser & Aydinalp 2008
Explanatory variables		
CO2E	Carbon oxide emission	Cresser & Aydinalp 2008
GGE	Greenhouse gas emission	Cresser & Aydinalp 2008
AME	Agriculture methane emission	Cresser & Aydinalp 2008
ANE	Agriculture nitrous oxide emission	Cresser & Aydinalp 2008
PD	Population density	Passel 2012

Study analysis is based on the impact of climate change on the agriculture productivity of Pakistan for the period of 1974 to 2013. Agriculture value added annual growth rate is the dependent variable, and the explanatory variables are as follows CO2 is the carbon oxide emission, greenhouse gas emission, agriculture methane emission, agriculture nitrous oxide emission and population density. A time series data of all economic variables is taken from the World Bank Metadata of Pakistan, Handbook Statistics of Pakistan.

Model specification

To check the Order of integration or stationary of data we used the Augmented Dickey Fuller. The extra lag length of dependent variable is included in ADF test to check the problem of autocorrelation in model. Autoregressive distributed lag model should be acceptable on the strength of the Augmented dickey fuller test as if all the selected determinants are integrated at dissimilar order like 1(0) and 1(1), is the basic requirement to use the autoregressive distributed lag model. Otherwise if all selected variables are integrated at 1(0) order then a simple OLS method is used, while, if order of integration is at 1(1) Johanson co-integration test is used.

To see the impact of agriculture productivity on economic growth the estimated equation is as follows

$$AVAG = \beta 0 + \beta_1 CO_2E + \beta_2 GGE + \beta_3 AME + \beta_4 ANE + \beta_5 PD + \varepsilon_i$$

Whereas,

ε_i is the Residual term, β0 is the intercept term B1, β2, β3, β4, β5, β6, β7 are the slope coefficient.

The estimated equation to see the impact of climate change on the agriculture productivity of Pakistan through agriculture value added annual growth rate is taken as dependent variable is as follows

$$AVAG = \beta 0 + \beta_1 CO_2E + \beta_2 GGE + \beta_3 AME + \beta_4 ANE + \beta_5 PD + \varepsilon_i$$

Whereas, ε_i is the Residual term and βo is the intercept term, while B1, β2, β3, β4, β5, β6, β7 are the slope coefficient

Whereas, unrestricted vector error model in presented as below.

General ARDL equation;

$$\Delta (AVAG)_t = \gamma_0 + \sum_{i=1}^{a} \gamma 1 (AVAG)_{t-i} + \sum_{i=0}^{b} \gamma 2 (CO2E)_{t-i} + \sum_{i=0}^{c} \gamma 3 (GGE)_{t-i} + \sum_{i=0}^{d} \gamma 4 (AME)_{t-i} + \sum_{i=0}^{e} \gamma 5 (ANE)_{t-i} + \sum_{i=0}^{e} \gamma 6 (PD)_{t-i} + \gamma_7 (AVAG)_{t-1} + \gamma 8 (CO2E)_{t-1} + \gamma 9 (GGE)_{t-1} + \gamma_{10} (AME)_{t-1} + \gamma_{11} (ANE)_{t-1} + \gamma_{12} (PD)_{t-1} \ldots \quad (1)$$

Equation 1 is the Auto regressive distributed lag model equation which presents the long run and short run relationship between explained and explanatory variable. γ_0 is the intercept term and short run coefficient of the determinants are as follows $\gamma 1, \gamma 2, \gamma 3, \gamma 4, \gamma 5, \gamma 6$ and the long run coefficients in auto regressive distributed lag model of the variables are as follows $\gamma 7, \gamma 8, \gamma 9, \gamma 10, \gamma 11, \gamma 12$ whereas, ε_I is the disturbance term.

Wald test (F- statistics)

The wald test is used to set up the long run association between explained and explanatory determinants.

Null Hypothesis

$H_0 = , \gamma 8, \gamma 9, \gamma 10, y 11, y 12, = 0$

(As no long run relationship exists)

Alternative Hypothesis

$H_1 = \gamma 7, \gamma 8, \gamma 9, \gamma 10, y 11, y 12 \neq 0$

(A long run relationship exists)

If the tabulated value is less than the F-statistics value then the alternative is accepted and null hypothesis is rejected, whereas if the tabulated value is greater than the F-statistics value than the alternative is rejected and null is accepted.

Long Run Relationship

The longer period relationship between explained and explanatory variable is presented in the following equation.

$$(AVAG)_{t-i} = \alpha + \sum_{i=1}^{z1} \alpha 1i (AVAG)_{t-i} + \sum_{i=0}^{z2} \alpha 2i (CO2E)_{t-I} + \sum_{i=0}^{z3} \alpha 3 (GGE)_{t-i} + \sum_{i=0}^{z4} \alpha 4 (AME)_{t-i} + \sum_{i=0}^{z5} \alpha 5 (ANE)_{t-i} + \sum_{i=0}^{z6} \alpha 6 (PD)_{t-i} + \varepsilon_i \ldots (2)$$

Short run relationship

The short run relationship between explained and explanatory determinants is presented by the equation 3rd. the error correction term lagged as (ECM)t-1 is added in the equation to regulate the consequences.

$$\Delta (AVAG)_t = \gamma_0 + \sum_{i=1}^{k1} \gamma 1i (AVAG)_{t-i} + \sum_{i=0}^{k2} \gamma 2i (CO2E)_{t-i} + \sum_{i=0}^{k3} \gamma 3i (GGE)_{t-i} + \sum_{i=0}^{k4} \gamma 4i (AME)_{t-i} + \sum_{i=0}^{k5} \gamma 5i (ANE)_{t-i} + \sum_{i=0}^{k6} \gamma 6i (PD)_{t-i} + \lambda (ECM)_{t-i} + \varepsilon_I \ldots (3)$$

(ECMt-i) error correction model presents the shorter period effect on the X and Y variable, longer period effect on the X and Y variable and speed of adjustment.

$\Delta P_t = \gamma + \delta\Delta_{t-1} + \lambda\,(ECM_{t-1}) + \varepsilon_I$ . . . . (4)

ECM_{t-i} error correction term is shown by equation 4, in this equation δ shows the shorter period effect and λ shows speed of modification. Disequilibrium value is shown by the error correction term.

Data Analysis

In mean estimation mean, standard deviation, skewness, and probability values of variables are presented. Table 2 is the general statistical description of the variables. Kurtosis and probability values are important in the analysis. The value of Kurtosis shows that the variable is platy kurtic or leptokurtic. Agriculture value added annual growth rate and agriculture nitrous oxide emission has a high peaked or leptokurtic distribution, while carbon oxide emission, greenhouse gas emission, agriculture methane emission and population density is platy kurtic. Jarque- Bera test of normality shows the combined results of kurtosis and skewness. JB test of normality shows that the 'p' computed value of all variables is higher in ratio so all the variables are normally distributed.

Table 2: Mean estimation

Variables	mean	St. dev.	Skewness	Kurtosis	J.B.	Prob.
AVAG	3.554803	3.525335	-0.267377	3.872922	1.746591	0.417573
CO2E	86033.54	48736.52	0.310453	1.774834	3.144260	0.207603
GGE	213052.8	87939.36	0.418402	1.894369	3.204438	0.201449
AME	69.53240	5.491149	0.251463	1.749928	3.026025	0.220246
ANE	72.81305	4.381496	-0.583348	2.564876	2.578990	0.275410
PD	154.5211	45.74247	0.099833	1.787039	2.518570	0.283857

Source: Author's calculations

Augmented Dickey Fuller Test

Null Hypothesis: Data has a unit root or variables are not stationary

Alt Hypothesis: Data has not unit root or variables are stationary

Table 3 is representing augmented dickey fuller test for the stationary of the variables

Variables	At level		At 1st Difference		At 2nd Difference		
	Inter cept	Intr. & trend	Intercept	Intr. & trend	Inter cept	Intr. & trend	Integra tion
AVAG	-7.811927		-	-	-	-	I(0)
CO2E	-	-	-5.475080	-	-	-	I(1)
GGE	-	-	- 4.775897	-	-	-	I(1)
AME	-	-	-5.300221	-	-	-	I(1)
ANE	-	-	-7.820615	-	-	-	I(1)
PD	-	-	- 5.49420	-	-	-	I(1)

Source: Author's calculations

The Augmented dickey fuller test is used to check the stationary of the dataset either it has a unit root or not. Probability value of the dickey fuller test checks the further statistical test to be applied on the variables. In our hypothesis analysis null hypothesis is that dataset has not stationary, while according to alternative hypothesis the dataset is stationary. To check the stationary we apply the augmented dickey fuller test results are presented in the table 3. Mix trend of co integration is observed as dependent variables are integrated at level as agriculture value added annual growth rate, explanatory variables have co integration at first difference.

Table: 4 Bound Test for Co-integration

Equation	F-Statistics Calculated	Lower Bound Critical Value	Conclusion
Equation (1) AVAG / CO2E, GGE, AME, ANE, PD	2.39 [0.0118]	2.26 (90%)	Co-integration exist

Source: authors' calculation, computed F-statistics is 2.39 (significance at 1% level of marginal values). Critical values is as k = 6-1= 5 is cited from the pesran et al (2001), case 111: unrestricted intercept and no trend. The numbers in parenthesis is shows the probabilities of F-statistics. Bound test shows that all the variables have long run association.

Table 4 is presenting the results of bound test. In the auto regressive distributed lag model f statistics calculated vale of the bound test is important, if the f statistics calculated value is greater than the lower bound critical value which is measured by the bound testing table then we can further measure the short run and long run analysis of the auto regressive model.

Table 5: Long Run Model

Dependent Variable: AVAG				
Method: Least Squares				
Sample: 1974 2013				
Included observations: 40				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.154888	0.049180	-3.149395	0.0033
CO2E	-0.071014	0.002299	-0.352319	0.0267
GGE	0.370054	0.024576	-1.914631	0.0635
AME	0.387001	0.015977	24.22275	0.7541
ANE	-0.021020	0.001390	1.452984	0.0549
PD	-0.027180	0.001454	-0.259894	0.0964

Table 5 is presenting the long run relationships among variables. Probability value shows the statistical significance of the all explanatory variables. To analyze the relationship between climate change and its impact on the agriculture productivity in Pakistan Auto regressive distributed lag model has been used. In the long run period the relation between variables is discussed as, the value of coefficient shows one unit increases in carbon oxide emission will cause 0.071-unit decrease in agriculture productivity in Pakistan. At the same time, one unit increases in greenhouse gas emission will cause to a 0.37-unit increase in agriculture value added annual growth in Pakistan. The probability value of greenhouse gas emission is 6.35 which shows it is statistical significant at 10% level of significance. The value of coefficient shows the one unit increases in the agriculture methane emission will cause to it 0.38 unit increase in agriculture value added growth in Pakistan. Probability value of agriculture methane emission is 75.41 which to higher than 5% or 10% level of significance so, the agriculture methane emission in not statistical significance. The value of coefficient shows one-unit increase in agriculture nitrous oxide due to a -0.021-unit decrease in agriculture value added in Pakistan. Probability value 0.054 shows that the variable is significant at 10% level of significance. The value of coefficient shows the one-unit increase population density due to a -0.0271-unit decrease in agriculture value added annual growth in Pakistan. The performance of variables shows that there exist the long run relationships between the climate change and agriculture value added annual growth rate in Pakistan.

Table 6: Short Run Model

Dependent Variable: D(AVAG)				
Method: Least Squares				
Sample (adjusted): 1973 2012S				
Included observations: 40 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010713	0.003953	2.710049	0.0118
D(AVAG(-2))	0.244354	0.161099	1.516787	0.1414
D(CO2E)	-0.000228	0.000674	-0.338566	0.0377
D(CO2E(-2))	0.001174	0.000630	1.848633	0.0718
D(GGE)	-0.023247	0.016115	-1.448149	0.0595
D(GGE(-2))	0.000578	0.016281	0.042174	0.0862
D(AME)	0.063558	0.028951	2.195361	0.0373
D(AME(-2))	-0.030368	0.039500	-0.768813	0.4489
D(ANE)	0.001146	0.000546	2.099993	0.0456
D(ANE(-2))	0.000986	0.000604	1.632373	0.0047
D(PD)	0.002303	0.001057	2.179133	0.0386
D(PD(-2))	0.000955	0.000786	1.215683	0.2350
ECT(-1)	-0.238412	0.102692	-2.321615	0.0284

In ARDL (auto regressive distributed lag) model vector error correction model used to measure short run association of the variables. Short run period behavior among dependent and independent variable is shown in above table. Above table shows that the carbon oxide emission and greenhouse gas emission with 2nd difference presents relationship with the agriculture value added annual growth at 10% probability value in the short period of time. The value of agriculture methane emission shows that there is no relationship between agriculture methane emission and agriculture value added annual growth in short period of time. Values of agriculture nitrous oxide emission describes that short run relationship exists between ANE and agriculture value added annual growth. In the shorter period of time the value of population density shows that it has no relationship with dependent variables. ECT (-1) representing the adjustment term value which is -0.2384 in short run period.

Table 7: Results of Regression Analyses

R-squared	0.881544	Mean dependent var	0.016220
Adjusted R-squared	0.243231	S.D. dependent var	0.023062
S.E. of regression	0.020074	Akaike info criterion	-4.717596
Sum squared resid	91.01047	Schwarz criterion	-4.163076
Log likelihood	104.9931	Hannan-Quinn criter.	-4.518639
F-statistic	2.012818	Durbin-Watson stat	1.917896
Prob(F-statistic)	0.025895		

In regression analysis r-squared value .8815 shows that the dependent variable has 88% dependence on explanatory variables. The probability value of F- statistics is below the 5% (0.025%) which shows the overall significance of the model. D- Statistics value 1.917 which is near about 2 so we can conclude that there is no autocorrelation in our model.

Table 8: Diagnostic Tests

Test Statistics	LM Version	F Version
Serial Correlation	CHSQ(1)= .012536[.904]	F(1, 26)= .010022[.921]
Functional Form	CHSQ(1)= 1.2336[.289]	F(1, 26)= .79153[.382]
Normality	CHSQ(2)= .18979[.905]	Not applicable
Heteroscedasticity	CHSQ(1)= 3.0105[.078]	F(1, 36)= 3.2095[.082]

Source: Author's calculation (Microsoft 4.1)

Diagnosting testing results shows that that there is no serial correlation among the variables and our variables are homoscedastic.

Stability test

CUSUM stability test in auto regressive distributed lags method (ARDL) is used to check the stability of the dataset. Selected variables and the dataset are stable because the cumulative sum of recursive residuals CUSUM graph is within the limits of 5% significance level and cumulative sum of square of recursive residuals CUSUMSQ graph is also within the limits of 5% significant.

CONCLUSIONS

Change in climate with every passing day is one of the largest situations that the world is facing. Climate change has direct impact on the production of agriculture in all over the world. Pakistan is mainly an agricultural foundation based country and thus the economy of the country is directly with agriculture and agricultural Productive, earlier in Pakistan more than 70% agriculture depends upon the rainfall directly, as a result the temperature and rainfall always plays an important role in Pakistan agricultural system. Climate change have positive and significant impact on the agriculture productivity in different districts of the Punjab are found by (Rehana Siddiqui, Ghulam Samad, Muhammad Nasir) similarly (by Usman Shakoor, Abdul Saboor, 2011). Thus, Pakistan has one third of its total cropped area under Rainfall and other is with proper irrigated canal system in Pakistan. As a result, 65% of agricultural in Pakistan is mostly relies upon the natural factors such, temperature, humidity, rainfall and so on.

Auto regressive distributed lag model presents the existence of the short run and long run relationship between the dependent and explanatory variables. Long run period shows the relation between variables that carbon oxide emission, greenhouse gas emission, agriculture nitrous oxide and population density have a positive significant impact on the agriculture value added annual growth and agriculture methane emission in not statistical significance. In the Short run period behavior the dependent and independent variable shows that the ECT (-1) is adjustment value which is -0.2384. Carbon oxide emission and greenhouse gas emission with 2nd difference presents relationship with the agriculture value added annual growth at 10% probability value in the short period of time. The value of agriculture methane emission shows that there is no relationship between agriculture methane emission and agriculture value added annual growth in short period of time. Values of agriculture nitrous oxide emission describes that short run relationship exists between agriculture nitrous oxide and agriculture value added annual growth. In the shorter period of time the value of population density shows that it has no relationship with dependent variables. Long run and short run relationship among variables shows the positive and significant impact of the climate change on agriculture productivity in Pakistan. Global environment and temperature is changing with every passing day. Climate change can be also seen in the shape of floods, drought and other changes in the weather situation during last 5 years in Pakistan. Pakistan is agriculture base country so the global climate changes and its severe impact on the productivity of agriculture cannot be ignored.

POLICY RECOMMENDATIONS

On the basis of findings and conclusions we make the following recommendations: -

- It is concluded from the results that government can participate with its role by monitoring the climate change and its impact on the agriculture and then distribute the results of this monitoring with formers.
- Government should invent the new crop varieties according the need of warmed, heat and drought areas.
- Governments built such Policies that increase the farmer flexibility allow farmers to adjust according to need of new circumstances. Lastly, government should help to organize the irrigation and development projects in high temperature areas.

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