Climate Change Impact on Food Security in Pakistan

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Abstract

The Green Revolution escorted in the 1960s bring the unprecedented transformation in the agricultural production, productivity, food security. However, it's now waned. In addition, the natural resources used for agricultural production, particularly the land and water, have diminished and deteriorated. These problems have further exacerbated by climate change and these extremes to weather fluctuation's effect the crops per yield productivity. In Pakistan, the effects of climate change are both beneficent and quantifiable. The basic purpose of the research was to known climate change impact on food security variable particularly wheat yield in the province of Punjab. Time series data used for estimation from 1990 to 2022 to gain the desired results or objective with sample size 32. Yield is dependent variable while the mean minimum temperature for sowing phase, mean minimum temperature for vegetation stage, mean maximum temperature for maturity stage and rainfall are used as independent variable. ARDL Bound test is used to check co integration among the variables. The results have indicated that if one Centigrade mean minimum temperature for sowing phase will increased the wheat yield decreased by 8.879016 kg and shows significant relation among the variables. At the Vegetation phase if mean maximum temperature increased by one Centigrade the yield of wheat decreased by 13.705017kg shows significant relation. At the maturity phase wheat productivity increased by 1.073163 kg due the result of increase one degree centigrade of mean maximum temperature. If sufficient amount of rain which increased the wheat yield by 70.921702 kg. It concludes that climate change is big tool of wheat yield at all period of wheat development.

***Keywords*:** Wheat, Climate Change, Temperature, Rainfall, ARDL

Introduction

Food security is a major concern for humanity of the world. It is, therefore, remained an important issue among food scientists, planners, and policymakers all over the world. Food security as an issue, which has been largely under discussion to explore ways and means for finding solutions to

ensure food for millions of inhabitants living on the earth (Tripathy et al., 2011).

Pakistan is an agrarian nation and their horticulture segment is influenced the most because of direct presentation to nature. Significant effect of atmosphere changes ison Agriculture creation because of changes in downpour designs temperature floods,dry spells, effect negatively on land productivity. Environmental change will impact harvest profitability and can affect nourishment security issue (Ali et al., 2017). Pakistan is the 6th largest Asian developing country with the population of 249 million (World Bank, 2022).

Atmosphere changes sway concentrates on crop determinates, however sway on fisheries, and domesticated animals' creation are no less genuine (Herero et al., 2015). Change in atmosphere is principally ascribed to the unabated increment in ozonedepleting substances, including prospered gases, carbon dioxide which makes change in downpour example, temperature, and negative effect on water and land assets, floods, and dry seasons. Environmental change is dealt with a Global marvel, anyway its effect is all the more generally felt in creating nations, because of more noteworthy powerlessness and lesser capacity to moderation the impact of environmental change (Ali et al., 2017). Diminishing danger to nourishment security from environmental changeis one of the significant difficulties of the 21st century. The effects of environmental change yields would already be able to recognize in watch information (Obersteiner et al., 2011). Agriculture continues to be the foundation of the Pakistani economy, accounting for 43% of employment and 20% of the nation's overall GDP. Pakistan's population of more than 2/3rds is rural (Government of Pakistan, 2003). If we consider about its production so its majors crops like rice, wheat, sugarcane and maize accounts for more the 75% of its harvest production. (Government of Pakistan, 2012-2013). The connection between environmental change and nourishment profitability has enormous been traded concentrating on the connection between atmosphere factors and farming. There is without a doubt huge and developing collection of writing that utilizes either agronomic models or examines greatness of these impacts (Duress & Hassan, 2010).

Almost each and every sector effected by the climate change but the agriculture sector is mainly affected due to climate change. The extreme rise and fall effect the agriculture productivity through different ways like unfavorable rainfall, temperature hike, water availability and evapotranspiration. Wheat is the one of the most important crops through the whole world. Climate change is likely considered one of the most important factors that effect the food production and supplies. Currently, about annual production of 600 Mt of wheat grain meets 25% of the world's protein needs and 20% of its energy needs. Pakistan is the self-sufficient in wheat production. Pakistan's primary granary is comprised of the provinces of

Punjab and Sindh, which produce more than 90% of the nation's wheat (PARC, 2002).

Wheat is the staple nourishment crop in Pakistan and subsequently, nourishment security strategy for the most part center on wheat creation in the nation. Ranchers sow wheat in winter and gather it in summer. Prior to the blooming stage, cold temperature quicken wheat development process since high temperature can cause delay in the development of seedlings. Downpour fall can harm wheat creation during collecting at last prompting danger to nourishment security in Pakistan (Nasir et al., 2010).

Nourishment security has remained the first targets of the Government of Pakistan. Along these lines the policymaker invests significant energy in structuring sound nourishment approach prompting nourishment security. Different factors have sway on nourishment security including agronomic, institutional, political elements, what's moreatmosphere factors. Considering nourishment creation measurements, the examinations show significant effect of temperature and precipitation on nourishment creation (Mahmood et al., 2012).

Literature Review

Sabagh et al. (2022) investigates the effect of climate change on agriculture production in Asian countries. The study shows that due extreme climate change, the agriculture production is under threat especially in Asian region. There are several factors that effect the agriculture production including Heat, Waves, Floods, Drought and intensity of rainfall. The study also gives the future predication of climate change and predict that there is the significant increase in the temperature and intensity of rainfall. In the mid of century (2040-2069) it's predicated that the maximum rise of temperature will be 28oC and minimum will be 22 oC. The study also suggests in order to response these challenges of climate change there should be need of increase the climate smart agriculture practices and advanced technology to reduce the loss of production and increase the productivity.

Choufani et al. (2018) in their examination have assessed the effect of climate change across food system by using the outcome of nutrition's in developing economies. The study used the food system approach to estimate the bidirectional association between the climate change and food nutrition's. The study shows that there should be need of advancement in agriculture and food farming ways to minimize the negative aspects of climate change

Sajjad et al. (2017) in their investigation analyze the impact of green change e.g., peak temperature, slightest temperature, rain, moistness, relative stickiness and daylight in real harvests of Pakistan including, Wheat, Rice, Maize and Sugarcane. Time series data was utilized for the season of 1989 to 2015. The strategies for Feasible Generalized Least Square (FGLS) and Heteroscedasticity and Autocorrelation (HAC) consistent standard were

utilized. Their outcomes uncovered that the greatest temperature negatively affected wheat creation and was critical, while the base temperature emphatically impacts the generation of all yields yet had an inconsequential effect. Precipitation negatively affected the creation of all yields aside from wheat and was irrelevant. They analyzed that the general effect of environmental change was observed to be antagonistic for the real sustenance crops. They expressed that greater part of the number of inhabitants in Pakistan is living on the neediness line and the populace is developing altogether consequently the administration needs to take firm activities to defeat the issue and guarantee the majority with adequate nourishment supplies.

Parajul and Devkota (2015), their paper assessed the effect of environmental change on wheat creation in Nepal. Their paper analyzed the region level fixed panel effect on per hectare net wheat incomes with atmospheric factors like precipitation and temperature including different sources of info. The outcomes demonstrated that both temperature and precipitation caused negative effects on net wheat incomes coming about because of wheat creation. Be that as it may, the information sources, for example, populace thickness, excrement utilized, human work, compensation, propelled seed and manure utilized were emphatically related with net incomes. They reasoned that the environmental change at first advances wheat creation in Nepal, yet after certain limit level it may not.

Zulfiqar and Ashfaq (2014) in their investigation evaluated the wheat yield reaction work in two agro-natural zones in Punjab. The examination was led for the season of 1979-2009.The strategy for Ordinary Least Square (OLS) was utilized. The zones of Faisalabad and Bahawalpur were taken for the reaction work.

Passel et al. (2012) effect of climate on European agriculture. A complete data set of European agriculture statistics, current climate, projected climatic scenarios, socioeconomic factors, and geographic variables for 923 NUTS3 (Nomenclature of Territorial Units for Statistics) regions in the EU-15 was constructed. A continental scale Ricardian analysis was used to examine the impact. The results showed that Farmland values across the Europe were found to be sensitive to climate change; in Southern Europe farm's size face the loss of (8% - 13% per degree Celsius) from warming. Whereas the rest of the Europe was found to have mixed impacts, with increase rain the average farm values and production increased by 3% per centiliter of precipitation.

Ashfaq et al. (2011) in their examination have assessed the effect of ecological change on wheat gainfulness in varied sector of Punjab locale. A period game plan data from 1980-81 was used as a piece of their examination to achieve the pined for target. They analyzed the impact of climatic factors

nearby some money related inspiring powers. Standard Least Square (OLS) was used to separate the impact of environment on wheat age. The results exhibited that one-degree centigrade addition in mean slightest temperature at sowing stage will fabricate the proficiency by 146.57 kg/ha. In spite of the fact that it is not significant, the mean highest temperature at the vegetation organization will lower productivity. The the gainfulness get will be136.63 kg/ha at maturity stage on account of one-degree centigrade augmentation in mean most outrageous high temperature and the ample measure of precipitation extended the wheat productivity is estimated 258.59 kg/ha. While the effect of financial constituents was for the most part level and predictable. They construed that natural change is the genuine element to wheat wheat production effectiveness at each level of wheat improvement.

Cabas et al. (2009) directed their examination to look at the impacts of climatic and non-climatic factors on mean and change of corn, soybean and winter wheat yield in Southern Western Ontario, Canada. The time taken for this examination was of 26 years. The outcomes demonstrated that the normal product yield expanded at a diminishing rate with the sum of information sources utilized, and diminish with the region planted to the harvest. Increments in the changeability of temperature and precipitation diminished mean yield and expanded its difference. The future atmosphere projections recommended that the normal product yield will increment with hotter temperatures a more drawn-out developing season. Atmosphere factors majorly affected product yield circulation.

Theoretical Framework

It is actually to facilitate Pakistan is an agrarian country and it contributes 20% of the total GDP and employing 43% of work force. Besides this it faces the threat of climate change and has adverse impact on food crops like Wheat, rice, maize and cash crops sugarcane. The Impact of environmental change have been expounded in numerous examinations on nourishment security however not explicit district. The problem statement is that what is the influence of Climate change variables on Wheat yield in mixed economic zone of Punjab?

Hypothesis 1: There is a negative relationship between minimum temperatures (sowing stage) and maximum temperature (vegetation stage) on Wheat Yield.

According to Asseng and Turner (2011) due to global warming there is the average increase in global temperature over the last decades and also predicted that this global warming will increase day by day. However the extremes of weather or temperature directly impact the wheat productivity. A shortened growing period is the outcome of phenological development that is generally accelerated by rising temperatures. Under field conditions and in

temperature-tunnel trials, irrigated, well-watered wheat crops have shown decreased grain yields in response to rising mean temperatures during the growing season. Kim et al. (2019) the study also argue that the minimum temperature also effects the efficiency of the wheat production. It's predicted that the average rate of maximum temperature for wheat in Pakistan is between the 23-27OC while the minimum temperature falls between the 3-8OC respectively

Hypothesis 2: There is a significant relationship between the rainfall and Wheat Yield.

There are the different factor that use for the wheat cultivate such as land water, fertilizer's, technology rain fall also an important factor for wheat production. Kanninen et al. (2007) also explains the importance of temperature and rainfall for agriculture productivity the study argues that the sufficient amount of rainfall effect positively. Statistically that data predict that increase in the variability of the rain increase the wheat productivity 4.66%. Pakistan faces the shortage of water and drought from the last decades in order to reduce all the aspects there is need of judicial use of available irrigation water.

Model Specification and Methodology

Model Building

Diverse studies such as Ashfaq et al. (2011) has used different factor for resolve of food security variable like wheat yield. This study is different from previous in this study mixed economic zone was selected for the aim of estimation the impact of climate change on food security variable wheat yield. The Punjab area, contributes significantly in nourishment protections in Pakistan 80% of wheat developing in Punjab territory. Faisalabad district selected form mixed economic zone and it cover largely from the total area of wheat than the other districts. The study examined the impact of climate change in which use the minimum temperature for sowing stage, Maximum temperature for vegetation, Total Rainfall on Pakistan agriculture production from 1990 to 2022 to gain the desired results or objective with sample size 32. Data Collected from AMIS (Agriculture Marketing Wing Punjab), Economic survey of Pakistan, Regional Meteorological Center and Punjab Development Statistics. The econometrics equation first shows the relationship of wheat and temperature and rainfall.

$$Y = \beta o + \beta 1MINS + \beta 2MAXV + \beta 3MAXM + \beta 4RAIN + E \ldots\ldots\ldots (1)$$

Y = Yield

B1 = Minimum temperature for sowing stage

B2 = Maximum temperature for vegetation stage

B3 = Maximum temperature for maturity stage

B4=Rainfall

βo = Intercept

E = Error term or residual

β = (β1, β2, β3 β4, β5, β6) sloop coefficients

Variable Description and Data Source

Dependent Variable

The dependent variable of this study wheat yield in (thousand tons). Data Collected from AMIS (Agriculture Marketing Wing Punjab), Economic survey of Pakistan, Regional Meteorological Center and Punjab Development Statistics.

Independent Variable

In the current study there are independent Climatic variables which show the impact of temperature and rainfall in various cropping Zone of Punjab for three growth stages.

Mean Minimum Temperature (Sowing Stage)

Wheat Crop is Rabi crop, and it is grown in winter. The mean maximum temperature estimates the impact on yield in the sowing stage for wheat which is for month of November and December (Ashfaq et al., 2011).

Mean Maximum Temperature (Vegetation Stage)

The mean maximum temperature estimates the impact on yield in the Vegetation stage for wheat which is for month of January and February (Ashfaq et al., 2011).

Mean Maximum Temperature (Maturity Stage)

The mean maximum temperature estimates the impact on yield in the Maturity stage for wheat which is for month of March and April (Ashfaq et al., 2011).

Total Rainfall Dummy

The total Rainfall dummy is the total amount of rainfall in the stages of wheat, created as dummy variables. If the total rainfall is greater than 70 the dummy otherwise is 0.

Methodology

In econometrics different technique are used but in this we utilize unit root test or Augmented Dickey-Fuller test used for testing (1979), the ADF test consist the fitting regression model:

$\Delta Yt = \alpha 0 + \delta Yt{-}1 + \alpha 1t + \sum \beta \Delta Y\ t{-}i + \varepsilon t$ (a)

We used ADF (Augmented Dickey-Fuller) for the purpose of which checking variables stationary or not, and after checking we conclude the variables to be stationary only when T-statistics is less than T-critical values. The hypothesis for the test are as follows:

H1= it is non- stationary in the series Ho= It is stationary in the series

For the purpose of stationary investigation, the study used the Augmented Dickey-Fuller test and concluded the variable stationary. If the significant value is less than statistical value, we accept H, to the study can conclude that the variable is stationary. If some variables stationary at 1st difference and some variables are stationary at level, we used ARDL (Autoregressive Distributed Lag Model). To examine the effects of climatic factors, such as the mean annual rainfall, mean maximum temperature for vegetation, mean minimum temperature for maturity, and mean minimum temperature for sowing on wheat yield. Some Assumptions of ADRL are which of the first no autocorrelation occurs in data second is no heteroscedastic phenomena occurs in data third is no one variables stationary at 2nd difference fourth is data should be stationary purely at level (0) or purely first difference (1)

Empirical Findings

Table1: Descriptive Statistics of Study Variables

	Yield (tons)	Mini temp sowing stage (C)	Maxi temp vegetation stage (C)	Maxi temp maturity stage (C)	Total rainfall dummy (mm)
Mean	23.98182	9.62909	21.10970	31.30606	110.2887
Median	25.00000	9.700000	21.10000	31.22000	104.1020
Maximum	28.60000	11.14000	23.39000	35.39000	208.5000
Minimum	16.50000	7.430000	18.90000	28.73000	39.96800
Std. Dev.	3.753786	0.887551	1.038025	1.637815	42.32115
Skewness	-0.501890	-0.460672	0.326174	0.716049	0.339085
Kurtosis	1.861431	2.799444	2.899131	3.226726	2.694091

Table number 1 shows the results of descriptive statistics The Descriptive statistics represents the characteristics of data and tells us how to handle this, first of all it tells us the central tendency in which mean, median, mode are included SD it represents the volatility of the data. The results represent the summary of statistics that Yield has an average value of 23.98181 and standard Deviation 3.753786 is the dispersion of distributed data from mean value, Kurtosis and skewness describes the distribution of

the data if the kurtosis more than 3 than exist normal distribution. If the Skewness has 0 value than exist normal distributed. We check the probability value, if the probability value is less than 0.05 it means residual are not normally distributed, if the probability value more than the 0.05 than we say residual are normal circulated.

H1= residuals are not usually distributed Ho = residuals are normally distributed. Probability values of all the variables are more than 0.05 so we cannot reject Ho, which means that residual of each variable is normally distributed.

Correlation analysis

Table 2: Correlation between variables

Variables	(1)	(2)	(3)	(4)	(5)
(1) WheatYieldmill~s	1.000				
(2) MeanMinTempera~a	0.895	1.000			
(3) MeanMaxTempera~n	-0.669	0.127	1.000		
(4) MeanMaxTempera~S	0.650	0.164	0.110	1.000	
(5) TotalRainfallD~m	-0.712	-0.040	-0.178	-0.556	1.000

The correlation table provided shows the correlation coefficients between different variables. Each cell in the table represents the correlation coefficient between two variables. Here's an interpretation of the correlation table: Wheat Yield (in million tons) and itself: The correlation coefficient between the wheat yield and itself is 1. This is expected since it represents the correlation of a variable with itself, resulting in a perfect positive correlation. Wheat Yield (in million tons) and Mean Minimum Temperature: The correlation coefficient between wheat yield and mean minimum temperature is 0.895. This indicates a strong positive correlation between these two variables. As the mean minimum temperature increases, there is a tendency for wheat yield to also increase. Wheat Yield (in million tons) and Mean Maximum Temperature: The correlation coefficient between wheat yield and mean maximum temperature is -0.669. This indicates a moderate negative correlation between these two variables. As the mean maximum temperature increases, there is a tendency for wheat yield to decrease. Wheat Yield (in million tons) and Mean Maximum Temperature of Summer: The correlation coefficient between wheat yield and mean maximum temperature of summer is 0.650. This indicates a moderate positive correlation between these two

variables. An increase in the mean maximum temperature of summer is associated with a tendency for wheat yield to increase.

Wheat Yield (in million tons) and Total Rainfall during the Year: The correlation coefficient between wheat yield and total rainfall during the year is -0.712. This indicates a strong negative correlation between these two variables. As the total rainfall during the year increases, there is a tendency for wheat yield to decrease. The correlation table shows the relationships between wheat yield and different weather variables. Mean minimum temperature has a strong positive correlation, mean maximum temperature has a moderate negative correlation, mean maximum temperature of summer has a moderate positive correlation, and total rainfall during the year has a strong negative correlation with wheat yield.

Table 2: Unit Root Test

Variable	Test for Unit Root	Statistical Value	Critical Value	Probability	Result
Y	1st difference	-12.25067	-3.562882	0.0000	1(0)
MINS	Level	-5.292088	-2.957110	0.0001	1(0)
MAXV	Level	-5.506	-2.957110	0.0000	1(0)
MAXM	Level	-4.220280	-2.957110	0.0024	1(0)
RAIN	Level	-3.679007	-2.963972	0.0098	1(0)

Different techniques are used for the purpose of stationary or non-stationary of the data. First of all this research has used ADF (Augmented Dickey Fuller) test used for stationary or non-stationary data. Table No 2 describes the results of ADF test and dependent variable wheat and independent variable minimum temperature for sowing stage, maximum temperature for vegetation stage, and maximum temperature for maturity stage. The dependent variable wheat is not stationary at level it is stationary at first difference with intercept and trend & intercept level of significance normally used 5% level of consequence. Where the probability value less than 0.05 and the independent variable minimum temperature for sowing stage is stationary at level, all explanatory variables are stationary at level with intercept and trend. In which some of the variables are immobile at level and some of the variable stationary at first difference. Anyone variable not stationary at 2nd difference and the outcome of all variable are 1(0) not variables has result 1(2).

Table 3: ARDL Bound Test

t-Statistics	Values	k
F-Statistics	5.817788	4
Critical Value Bounds		

Significance	I0 Bound	I1 Bound
10%	2.45s	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Table 3 shows the results of ARDL Bound test which represents the long run relationship exist or not. These tests used for the purpose of that co integration exist or not. It means long run relationship in projected variables. If the bound test to confirm calculated values more than upper slower values co integration. If the value of F-statistics calculated value comes more than the upper bound value we can say that cointegration exist. If the F-statistical value less than the lower bound value we can say that co integration not exist. If the F-statistical calculate value between the upper and lower bound than it is not confirmed that relation exist or not. But in above table result shows that the F-statistical calculated value is 5.817788, the lower bound 2.45 at 10% level of significance and the upper value 5.06 at the 1% level of significance but we conclude that F-statistical value more than upper and lower bound values this result shows that there is long run relationship exist.

Table 4: ARDL Co integration in Short Run Results

Variables	Coefficient	Std. Error	t- statistics	Probability
D(Y(-1)	-0.584037	0.209481	-2.788019	0.0317
D(MINS(-1))	-1.448003	0.299346	-4.837229	0.0029
D(MAXV(-1)	-2.016218	0.467742	-4.310533	0.0050
D(MAXM)	-0.812590	0.290788	-2.794441	0.0314
D(RAIN)	-4.389305	1.812678	-2.421448	0.0518
CointEq(-1)	0.361669	0.132868	2.722024	0.0345

Note. R2 = .966851, Adj R2 =0.845303 Porb(F-Statistics) =0.008115, DW=1.979520

Table 4 represents the results of ECM (error correction term). The value of ECM describe about the speed of adjustment to the equilibrium. How long did it take for the variables to return to equilibrium if they were to depart from it for whatever reason? The above value of table 4 shows the value of ECM 0.361669, the limit of the ECM should be between the (0,-2). The results indicate that the ECM value falls within the previously specified range, and the model supports this finding because the probability value in the above table is less than the alpha value.

Table 5: Co integration in the Long Run

Variables	Coefficient	Std. Error	t- statistics	Probability
MINS	-8.879016	3.058638	-2.902931	0.0272
MAXV	-13.705017	2.531203	-5.414428	0.0016

MAXM	4.723181	1.034048	4.567663	0.0038
RAIN	70.921702	17.430314	4.068871	0.0066

Table 4 shows the results of long run of ARDL model findings conformed that there is negative or significant relationship between in which variable MINS minimum temperature for sowing stage and MAXV maximum temperature for vegetation stage MAXM maximum temperature for maturity stage. First of all explain the concept of coefficient. The Coefficient are telling us the relationship among the variables that the relation positive or negative. MINS according to the results if minimum temperature sowing increase by one degree centigrade, then wheat yield wished decreased by 8.879016 units, on average while keeping every other element constant and since the probability less than alpha. we draw the conclusion that the variable is significant, and it shows the negative relationship among dependent variable. MAXV maximum temperature vegetation according to the results if maximum temperature vegetation increases by one degree centigrade, then wheat yield would decrease by 13.705017 units, on average keeping in view all the other factor constant and since the probability value less than alpha we conclude that variable significance, and it shows the negative relationship among dependent variable. MAXM minimum temperature maturity stage, according to the results if maximum temperature for maturity stage increases by one degree centigrade, then wheat yield would increase by 4.723181 units, it shows the positive relationship among dependent variable. RAIN rainfall according to the results if the total rainfall increases by 70 mm, the wheat yield would increase by 70.921702 units in comparison the benchmark category and it has positive relationship between Rainfall and Wheat yield. Since the probability value less than alpha the variable is significance. At the last the Value of R2 shows the portion the changings will be occurred in the dependent variable due to the changing in explained by explanatory variables. While its value will be lies between the 0-1 furthermore in the in multiple regression model in these results the value of 0.926851 it shows strong relation. and the value of p less than alpha it is significant

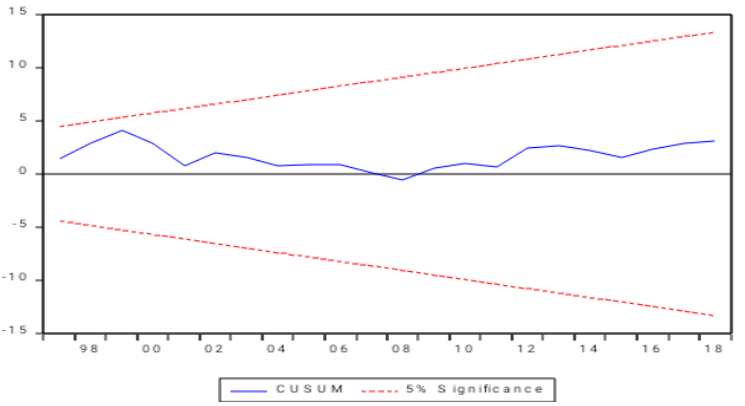

Figure 1: Plot of Cumulative Sum of Recursive

Figure 1 shows the results of Cu sum test represents the stability of the model. It tells us about the structural breaks. The rule thumb state that if the below line crosses the red line than the stability not exist in the model.

Conclusion

Climate change is most important tool of wheat yield in all the growth stages. Temperature and rainfall have significant and vital role to play when there is no proper irrigation sector set up and not facilitate to the farm. Most of the areas of the Punjab are also not better and facing the problems of electricity shortage, hire prices of electricity for the poor farmer so if the dangerous climate effects his crops than all the powers and efforts of the farmer are wasted or destroy. Different research was performed to measure the impact of climatic variable on food security. In order to measure the impact of climatic variables a study is carried to see the implication of wheat in economic zoon in Punjab. Results of this research were different form the previous study held by (Ashfaq et al., 2011) because of the climatic time periods of crops and climate change as well.

Wheat yield which demonstrated that an expansion in the extreme temperature accelerate the improvement cycle and reduce the grain filling period. At the maturity phase yield increment significantly with an expansion in mean minimum temperature.

Rainfall has important climate variable and have positive relationship with the yield, which means that an increase in better and adequate amount or rainfall increase the wheat yield increase is significant.

Recommendation

There is need Government should give the electricity with low charges to the poor farmer. Modern methods of production are used to increase the productivity. There is necessary to make sure that the harvesting of sugar crop is done on time, so that it doesn't cause delay in the sowing of

the wheat which might cause losses in the field. Adaptation measure should be taken in the sowing period in order to keep the crop safe from smog and fog scenario in the region.

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