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RISK ASSESSMENT OF CLIMATE VARIABILITY ON RICE PRODUCTIVITY IN SINDH PROVINCE OF PAKISTAN

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ABSTRACT

The focus of the present research was to assess the dependent variable i.e., Vector Autoregression (VAR) study model estimation with lag 2 indicated that Akaike AIC and Schwarz Sc for data using lag 2 is smaller than lag 3, lag 4 and lag 5, so the lower values Akaike AIC 17.11070 and Schwarz Sc 19.23172 for lag 2 make the model more fitted. For that reason, VAR model lag 2 in the study is more prefer-able as compared to other lag values. The ADF test showed the variables of model to be non- stationary at straight levels of significance and indicated that the first difference variables are completely stationary, which showed that all the variables are integrated of order-1, whereas water availability data is already in the stationary form. Area under rice crop is not expected to be different from the 2014-15 and the productivity is forecasted as 42.6 mds per hectare, which is a good yield but not good enough, and most probably due to the climatic uncertainty. Furthermore, the econometric results illustrated that the increase in temperatures and a decrease in precipitation tendency would cause less or more negative impact on rice productivity in up-coming years in the province of Sindh, where estimated productivity will get decreased by 7.32 percent in the short-run and 13.31 percent in the long-run with an increase in temperature by 1°C and 10 percent decrease in precipitation. Results showed decline in the productivity of the crop under study area. This might be an alarming situation and the big threats to agricultural productivity associated with rapid climate changes. A well-defined planning and sagacious policies will play sustainable productivity of the rice crop. New hybrid and climatic change resistance crop varieties may be introduced to secure the staple food crops including rice for food security.

Keywords: climate change, productivity, rice, Sindh, vector autoregression (VAR)

INTRODUCTION

Climate change can be defined as the rise in an average surface temperature of the earth. This phenomenon is also known as global warming. Climate can be termed as "expected weather", so when the changes are encountered in expected weather, they are called climate change. They can be explained by the

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differences between average weather conditions at two separate times. In 2010, Pakistan was addressed as the top most country in the world affected by climate related disasters; and in 2011, it was on number three (03) rank. Because of the varied demographic and topographic structure of Pakistan, it is considered amongst in the list of highly vulnerable world countries which are under the adverse impact of climate change. Climate plays holistically significant role for agricultural productivity. It is a key factor in the production of crops. A new term is also being coined since last few years, named "Climate Change" which is hanging around the world. This is an enormous challenge for societies worldwide. The release of 'greenhouse' gases into the atmosphere is the reason behind the occurrence of climate change. These gases get accumulated in the atmosphere and result in global warming. Many plant species are temperature sensitive; predicted increases in global temperatures will have adverse impact on our environment and put increasing stress on agriculture. Large numbers of people in the world still have no access to adequate food, ensuring global food security continues to be a big challenge.

Pakistan mostly exports rice to the countries like Saudi Arabia, Afghanistan, Iran and United Arab Emirates (UAE). Rice is the second most important food item used in the eating habits and same as it supplies 21 percent of entire world's human per capita energy and 15 percent of per capita protein (Ghulam *et al.,* 2012). It absolute food requirements all the way of our country with earning source of foreign exchange from its trade export on the other hand rice provides value added products or raw substance for manufacturing paper, mattresses, starch, etc. grain with its husk used as fodder for livestock.

The rice production is expected to be influenced by unseen future changes associated with global warming temperature, carbon dioxide and rainfall. Rapid change in climate can be noticed from extreme weather conditions and its effect on crop production and declining food security. Previous studies show the fact that the climate change causing increase in temperature and simultaneously cause adverse impact on rice crop and ultimately decrease the crop productivity and its quality. It was revealed by a comprehensive simulation research that the climate change since 1960s decreased yield of rice by 12.4%, but with largest contribution coming from lowering radiation. The positive and negative yield response in different regions was demonstrated through statistical analysis between climate variables and observed yield. Variations in mean temperatures, increasing weather changes and rising sea level predicted less but possibly even more significant effect on rice production. In Sindh, the cultivation of rice is around 02 million acres of agricultural fertile land and productivity or yield is nearly 45 to 50 maunds acre^{-1} with around fifty percent people of rural labor is attached with the crop of rice associated employ. At the large, such produces at 35 percent of the country's rice for yearly production at approximately 3.51 million tons from which 02.1 million tons from milled rice that produced from more than 800 major crop rice mills (Rasul, 2012).

Several districts of Sukkur division are mostly famous because of better quality of rice grain production. Another district namely Larkana is ranked first and further rice is also cultivated in some other districts of Sindh province such as; Hyderabad, Khairpur, Dadu and Nawabshah. The most important and major rice varieties by give n common in the Sindh are Sindhi Basmatti, Begghi, Kangnee, IRRI-6, D-98 and IRRI-9, etc. (Ghulam *et al.*, 2012).

Almost 11 percent of the total agricultural land of the country is being cultivated with rice and similarly the country has another prominent mark due to the primary exporter after cotton and producer of “Basmati” “D-98” and “IRRI” variety rice. Value added in sector agriculture the crop rice is placed and accounts 2.73 percent as well as 0.95 percent sectoral share in country’s gross domestic production (GDP) (GoP, 2015). Two provinces of Pakistan mainly produce the crop rice with remarkable production, namely Sindh and Punjab. About 90 percent production of rice crop produced from these two provinces on yearly basis. Punjab, have moderate agricultural climatic zone and with the suitable soil conditions, which is produced nearly 100 percent of the Basmati rice variety for the country (Ghulam *et al.*, 2012).

The production through 2014-15 is also adjusted upwards in accordance with the figures provided by the Government of Pakistan, tying the previous record rice production level. The main reason of rise in production is the increase in area and the deposit of a nutrient rich top layer of soil which is a result of successive floods in last few years, but with less yield or productivity just because of shifting in temperature and precipitation level. A fear started to grow after the monsoon floods of September 2014, that the rice crop would be unfavorably affected specially the rice land in the basmati growing areas. On the contrary, the increased production shows that the initial flood damage reports were inflated, in fact, benefitted the rice crop. The cropping zone in Sindh province Wheat-Fallow-Rice badly hit by upper limit temperature and shortage of water. This paper reports the results of the study conducted: to find out the current status and growth of rice crop in Sindh province and Pakistan, to examine and foretell the impact of climate change catastrophe on agricultural development with reference to the rice crop in Sindh and Pakistan, and to analyze the economic model for estimation of climate change threats and with suitable recommendations for sustainable production of rice crop.

MATERIALS AND METHODS

The research is based on two methodological approaches, determining the impacts of climate change (more precisely temperature and precipitation, variables on the productivity of rice crop in Sindh province of Pakistan). The method applies two different tools; one is exploratory research method and the Vector Autoregression (VAR). An exploratory research conducted due to not clearly “defined problem”. Exploratory research assists in determining the best research design, method of collecting data and selection of subjects. The goal of exploratory research is to learn, “what is going on here?” and to investigate social phenomena without explicit expectations (Russell, 2006). VAR is an econometric model which is used in capturing the linear interdependencies among multiple time series. The model calculates and analyzes the impact of fluctuations in climatic variables upon crop productivity or yield. The data examine the production practices perspective, the impacts of climate change on the yield of agricultural food crops and production. It, moreover examines how the climate changes are perceived by them?

Data collection

The time series data based on climatic change variables such as temperature and precipitation tendency and with major crop rice status viz area, production and productivity or yield of Sindh Province and Pakistan. The secondary data of climatic change variables were obtained from Pakistan metrological department. The data span for the last 20 years (1994 to 2015) due to the rapid climatic changes occurred during this period. The data regarding crop status were collected from various books, Pakistan Bureau of Statistics (PBS), Ministry of Food, Agriculture and Livestock (MINFAL), Government of Pakistan, FAO Publications, etc.

Statistical analysis

The data were statistically analyzed with the help of Statistical Package for Social Sciences. Descriptive and inferential statistics were used to accomplish meaningful results. Descriptive statistics was used to compute mean, standard deviation and standard error for policy analysis and for the sustainable development.

The Vector Autoregression (VAR) Model

Many economists suggested that the VAR model was mostly used in macroeconomics and it was an opinion of Christopher Sim and Litterman, that VAR model would better be used for the purpose of forecasting. The results of forecasting may be achieved through VAR whereas possibility of error cannot be avoided (Greene, 2002).

The study model VAR-econometric model explains the advancement of a set of *k* variables (endogenous variables) over the similar sample period ($t = 1, \ldots T$) as a linear function of their previous values. The variables are composed in a $k \times 1$ vector Y_t which has as the i^{th} element, $y_{i,t}$, the observation at time "*t*" of the i^{th} variable. For example, if the i^{th} variable is *GDP*, then $y_{i,t}$ is the value of *GDP* at time *t*. A p^{th} order VAR, indicated VAR (*p*), is written as:

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t,$$

Where;

The *l*-periods back observation y_{t-l} is called the l^{th} *lag* of *y*, *c* is a $k\times1$ vector of constants (intercepts), *Ai* is a *time-invariant* $k\times k$ matrix and e_t is a $k\times1$ vector of error terms satisfying:

1. $E(e_t) = 0$ i.e., the mean is zero in each error term;

2. $E(e_t e_t') = \Omega$ i.e., at the same time covariance matrix of error term is Ω (*a k × k* positive *semi-definite matrix*);

3. $E\left(e_t e_{t-k}^{'}\right) = 0$ For any *non-zero k*, there is no correlation across time; in particular, no serial correlation in individual error terms.

The model used specifically for the study constituted of the following equations;

Rice productivity = $\beta_1 - \beta_{2Temp} + \beta_{3Precip} + \beta_{4Acrdt} + \beta_{5rpp} + \beta_{6Fert} + \beta_{7Tech} + \beta_{8Lr} + \beta_{9Wa} + U_{i..}$ **1**

Where;

Yield/ productivity (f) = (Land for crop rice, procurement crop price, Precipitation, Temperature, Fertilizer use, Water Availability, Agricultural Credit and Technology +Ui).

RESULTS AND DISCUSSION

Rice crop is typically called Asian crop just because of nearly 90 percent of crop output and its consumption is intense in this particular region. It is the staple food for 50% of the world and 75% of the world's poor. Rice crop production in the Pakistan as value added that recorded at 3.21 percent for the sector of agriculture with 0.72 percent as whole of country's gross domestic production (GDP). For the period of July to March 2014-2015, this exportable crop received foreign earnings almost US $ 1.54 billion. In the same period, the crop rice planted with nearly 2892 in thousand hectares that detect an enhanced area under crop i.e. 3.61 percent over previous year's rice area of 2790 in thousand (000) hectares. Further, the crop rice documented at highest output of 7005 in thousand tons, with the growth of 3.01 percent during observed period of 2014-15 production that was 6798 in thousand tons (GoP, 2015). Rice production improved due to additional area under crop growing, appropriate accessibility of irrigation water supply and better yielding hybrid rice varieties (Sheikh *et al.,* 2016). Rice production is raised because more area brought under cultivation instead of natural practices due to more rapid changes occur in weather patterns (Climate Change). The status of the crop rice during last five years is shown in Table 1 and Figure 1-2.

Descriptive statistics

As a result of the more area under crop rice cultivation, for cause of timely availability of water for irrigation, and more acreage under high yielding hybrid rice varieties, there is a rise in rice production. The summary statistics of the climate and crop yield variables were used in the study. Table 2 indicated that the mean level of annual precipitation was 105.53 mm per annum with a standard deviation of 231.61 and the mean annual temperature over the past 20 years (1994-95 to 2014-15) was around 29.70°C with a standard deviation of 4.15°C Table 2.

The ADF unit root statistics

At conventional levels of significance, the ADF test indicated that the variables of the model are non- stationary (at 5% level of significance) and also it showed that at first difference the variables are stationary, indicating that study variables are integrated at difference first order-1, whereas water availability (wa) data were already in stationary appearance as shown in Table 3.

Table 1. Area, production and yield of rice in Sindh and Pakistan during 1994 to 2015

Year	Sindh			Pakistan		
	Area (in 000 ha)	**Production (in 000 tons)**	**Yield/ ha in kg**	**Area (in 000 ha)**	**Production (in 000 tons)**	**Yield/ha in kg**
1994-95	598.3	1406.7	2351	2124.6	3446.5	1622
1995-96	642.3	1697.2	2642	2161.8	3966.5	1835
1996-97	701.8	1961.5	2795	2251.1	4304.8	1912
1997-98	689.3	1840.9	2671	2317.3	4333.0	1870
1998-99	704.1	1930.3	2742	2423.6	4673.8	1928
1999-00	690.4	2123.0	3075	2515.4	5155.6	2050
2000-01	540.1	1682.3	3115	2376.6	4802.6	2021
2001-02	461.1	1159.1	2514	2114.2	3882.0	1836
2002-03	488.3	1299.7	2662	2225.2	4478.5	2013
2003-04	551.2	1432.8	2599	2460.6	4847.6	1970
2004-05	543.9	1499.7	2757	2519.6	5024.8	1994
2005-06	593.2	1721.0	2901	2621.4	5547.2	2116
2006-07	598.1	1761.8	2946	2581.2	5438.4	2107
2007-08	594.0	1817.7	3060	2515.4	5563.4	2212
2008-09	733.5	2537.1	3459	2962.6	6952.0	2347
2009-10	707.7	2422.3	3423	2883.1	6882.7	2387
2010-11	361.2	1230.3	3406	2365.3	4823.3	2039
2011-12	352.4	876.9	2223	2571.2	6160.4	2166
2012-13	603.2	1432.2	2018	2308.8	5535.9	2108
2013-14	579.8	1622.7	1942	2789.2	6798.1	2207
2014-15	632.5	1819.6	2089	2667.3	6573.3	2092

Source: Pakistan Bureau of Statistics 2014-15

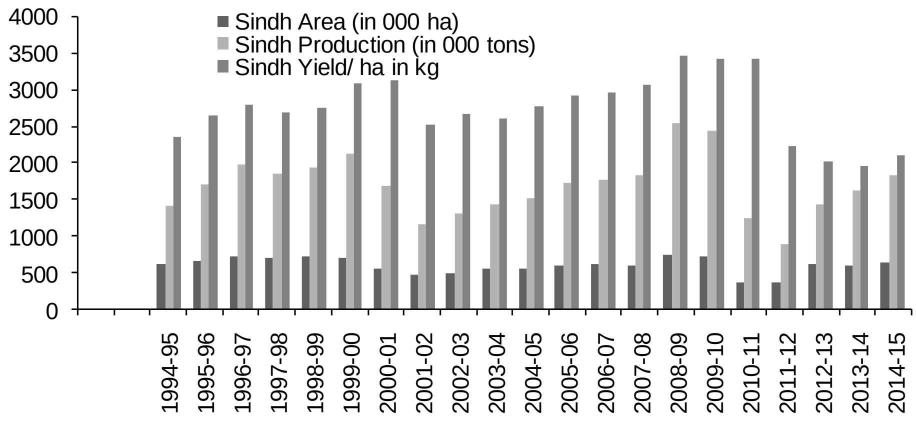

Figure 1. Rice area, production and yield of Sindh 1994-2015

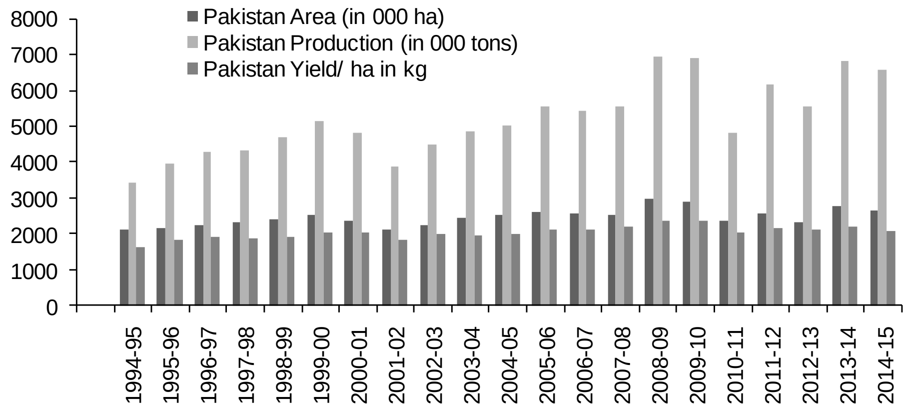

Figure 2. Rice area, production and yield of Pakistan 1994-2015

Table 2. Exogenous and endogenous VAR variables statistics

Variable	Unit	Mean	Standard Deviation	Minimum	Maximum
Rice yield	kg/ha	2234	917.70	1311	2774
Precipitation/ Rainfall	mm	105.51	231.62	43.71	58.53
Temperature	Celsius	29.70	4.15	21.68	49.19

Table 3. Results of the ADF unit root statistics

S.No.	Variables	Level	1st Difference	Conclusion
1	Rice production	0.4349	0.0000	I(1)
2	Avg. temperature	0.3202	0.0000	I(1)
3	Avg. precipitation	0.0016	0.0000	I(1)
4	Land under rice	0.0065	0.0000	I(1)
5	Water availability	0.0000	0.0000	I(0)
6	Technology	0.0012	0.0000	I(1)
7	Rice procurement price	0.1900	0.0000	I(1)
8	Fertilizers intake	0.7512	0.0000	I(1)
9	Agriculture credit	0.8959	0.0000	I(1)

Results from VAR-model

The study VAR-model estimation for variables are shown in Table 4. Accordingly the results Vector Autoregression (VAR) model assessment with respect to observed variables that t-statistics is not significant; while the high value F-test, statistically signify in study model's lag terms. On the other hand, the coefficient R-squared calculated between zero (0) to one (1) indicates the model validity. VAR study model estimation with lag 2 that Akaike AIC and Schwarz Sc for data using lag 2 is smaller than lag 3, lag 4 and lag 5, so the lower values Akaike AIC 17.11070 and Schwarz Sc 19.23172 for lag 2 had made the model more fitted. For that reason, VAR model lag 2 in the study is found more preferable as compared to other lag values.

Table 4. Results through VAR model- I: Vector Autoregression (VAR) Estimates, Sample (adjusted): 1994 2014, Included observations: 20 after adjustments, Standard errors are in ( ) and t-statistics are in [ ]

	Rp	Lr	Temp	Precip	Wa
Rp(-1)	0.478933	-0.004065	0.000291	-0.000130	-0.003238
	(0.42595)	(0.00328)	(0.00023)	(0.00170)	(0.00611)
	[1.12438]	[-1.23982]	(1.29084)	(-0.07642)	(-0.53034)
Rp(-2)	-0.086876	-0.005973	7.21E-06	0.000398	-0.011903
	(0.47973)	(0.00369)	(0.00022)	(0.00166)	(0.00596)
	[-0.18109]	[-1.61753]	(0.03277)	(0.23990)	(-1.99801)
Lr(-1)	-0.681204	-0.010127	-0.000982	0.000611	0.017136
	(0.31869)	(0.14462)	(0.00061)	(0.00460)	(0.01649)
	[-2.13754]	[-0.07003]	(-1.61264)	(0.13284)	(1.03902)
Lr (-2)	-0.589526	-0.212243	0.000171	0.001734	0.027766
	(0.53559)	(0.24305)	(0.00059)	(0.00449)	(0.01610)
	[-1.10070]	[-0.87324]	(0.28691)	(0.38616)	(1.72409)
Temp(-1)	-5.785.916	-2.475.781	0.500886	-0.140987	-2.531763
	-374.947	-170.152	(0.15982)	(1.20739)	(4.33000)
	[-1.54313]	[-1.45504]	(3.13408)	(-0.11677)	(-0.58470)
Temp(-2)	6.223.364	-2.722.957	0.308464	-0.229359	-1.188558
	-282.998	-128.425	(0.15626)	(1.18051)	(4.23358)
	[0.21991]	[-2.12027]	(1.97404)	(-0.19429)	(-0.28075)
Precip(-1)	-0.424279	0.000139	-0.000744	0.098245	1.209526
	-189.058	(0.00013)	(0.02277)	(0.17201)	(0.61687)
	[-0.22442]	[1.07252]	(-0.03266)	(0.57116)	(1.96076)
Precip(-2)	-3.014.134	-8.81E-06	0.000676	0.288965	0.484826
	-125.592	(0.00019)	(0.02449)	(0.18498)	(0.66338)
	[-2.39993]	[-0.04674]	(0.02759)	(1.56215)	(0.73084)
Wa(-1)	0.001286	-0.358860	0.004756	-0.067453	0.587948
	(0.00205)	(0.27464)	(0.01453)	(0.10977)	(0.39365)
	[0.62809]	[-1.30665]	(0.32734)	(-0.61451)	(1.49359)
Wa(-2)	0.002607	0.287142	-0.007814	0.037746	1.006996
	(0.00231)	(0.40012)	(0.01434)	(0.10835)	(0.38856)
	[-1.13082]	[0.71764]	(-0.54488)	(0.34838)	(2.59162)
C	-14849.00	6.718.212	6.089071	13.16633	-175.0879
	(13957.1)	(6333.75)	(3.67806)	(27.7867)	(99.6501)
	[-1.06391]	[1.06070]	(1.65551)	(0.47384)	(-1.75703)
R-squared	0.975264	0.901506	0.900114	0.300028	0.972362
Adj. R-squared	0.968392	0.874146	0.872368	0.105591	0.964685
Sum sq. resids	35851231	6000953.	35.11640	2004.230	25776.73
S.E. equation	997.9316	408.2807	0.987652	7.461438	26.75856
F-statistic	141.9349	32.95039	32.44117	1.543062	126.6564
Log likelihood	-384.9915	-342.9862	-59.84035	-154.8825	-214.9065
Akaike AIC	16.85070	15.06324	3.014483	7.058830	9.613042
Schwarz SC	17.28372	15.49626	3.447496	7.491843	10.04606
Mean dependent	12454.49	7058.340	18.40398	35.76338	132.4143
S.D. dependent	5613.135	1150.869	2.764549	7.889592	142.3912
Determinant	Residual	8.68E+14			
Covariance					
Log Likelihood		-1221.523			
Akaike Information Criteria	51.78231				
Schwarz Criteria		54.10034			

Table 5. Results through VAR model-II, Vector Autoregression (VAR) Estimates, Sample (adjusted): 1994-2014, Included observations: 20 after adjustments, Standard errors are in ( ) and t-statistics are in [ ]

	Rp	Acrdt.	Fert.	Tech.	Rpp.
Rp(-1)	-0.681204	-3.014.134	-0.122135	2.195.145	-0.003507
	(0.31869)	-125.592	(0.03767)	-111.371	(0.00469)
	[-2.13754]	[-2.39993]	[-3.24183]	[1.97101]	[-0.74723]
Rp(-2)	-0.589526	-0.207494	0.107189	2.084.824	-0.004937
	(0.53559)	-211.074	(0.06332)	-187.173	(0.00789)
	[-1.10070]	[-0.09830]	[1.69289]	[-1.11385]	[-0.62595]
Acrdt.(-1)	-0.004937	1.574.888	0.044750	-1.572.056	0.004306
	(0.00789)	(0.83117)	(0.02493)	(0.73705)	(0.00311)
	[-0.62595]	[1.89479]	[1.79480]	[-2.13290]	[1.38652]
Acrdt.(-2)	-0.021586	-0.891705	-0.023558	-0.363759	0.000237
	(0.15289)	(0.60253)	(0.01807)	(0.53431)	(0.00225)
	[-0.14118]	[-1.47993]	[-1.30337]	[-0.68081]	[0.10530]
Fert.(-1)	4.473.131	-4.551.582	0.236351	0.214908	0.146904
	-382.076	-150.574	(0.45169)	-133.524	(0.05627)
	[1.17074]	[-3.02282]	[0.52326]	[0.01610]	[2.61085]
Fert.(-2)	1.142.795	3.170.951	-0.137871	2.887.491	-0.138340
	-397.796	-156.769	(0.47027)	-139.018	(0.05858)
	[0.28728]	[2.02269]	[-0.29317]	[2.07707]	[-2.36148]
Tech.(-1)	0.082762	-0.358860	0.017002	-0.066342	0.000892
	(0.06969)	(0.27464)	(0.00824)	(0.24354)	(0.00103)
	[1.18759]	[-1.30665]	[2.06369]	[-0.27241]	[0.86877]
Tech.(-2)	-0.107189	0.287142	-0.018329	0.593091	-0.000886
	(0.10153)	(0.40012)	(0.01200)	(0.35482)	(0.00150)
	[-1.05574]	[0.71764]	[-1.52707]	[1.67155]	[-0.59225]
Rpp.(-1)	2.607.842	4.156.133	1.498.126	-3.314.215	0.776765
	-543.563	-214.215	-642.594	-189.959	(0.80048)
	[0.47977]	[1.94017]	[2.33137]	[-1.74470]	[0.97037]
Rpp.(-2)	1.062.276	2.990.020	-5.600.697	-3.314.215	-0.538397
	-443.583	-174.814	-524.399	-189.959	(0.65325)
	[-0.02395]	[0.17104]	[-1.06802]	[-1.74470]	[-0.82419]
R-squared	0.997254	0.997254	0.999133	0.995013	0.999452
Adj. R-squared	0.986269	0.986269	0.995666	0.975066	0.997258
Sum sq. resids	3917009	3917009	54742.99	47838214	8.494.911
S.E. equation	6.597.145	6.597.145	7.799.073	2.305.506	9.715.343
F-statistic	9.078.520	9.078.520	2.881.866	4.988.330	4.556.568
Log likelihood	3.263.717	3.263.717	2.281.517	3.839.291	1.323.391
Akaike AIC	1.579.877	1.579.877	1.152.834	1.830.127	7.362.569
Schwarz SC	1.726.963	1.726.963	1.299.920	1.977.213	8.833.432
Mean dep	13069.50	13069.50	1.634.292	19748.52	1.553.163
S.D. dependent	5.629.965	5.629.965	1.184.713	14600.72	1.855.416
Determinant residuals covariance (dof adj.)			2.61E+27		
Determinant residuals covariance			1.09E+21		
Log likelihood			-1.701.664		
Akaike information criterion			8.846.364		
Schwarz criterion			1.017.014		

As a result of monsoon floods of September 2014, a fear started to grow that there would be adverse impact on rice crop fields, especially in the basmati growing areas. On the other hand, the enhanced country's rice production just due to the initial flood damage reports was inflated and the floods essentially better for the rice crop and it's very natural.

CONCLUSION

This research concluded that the impact of climate change is the major threat to rice crop productivity and observed that adverse implications in their productivity and resultantly food insecurity is on alarming and its growth threat as well. It is pointed by the econometric results that increased temperatures and decreased precipitation would less or more negatively impression on rice crop yield over the province of Sindh, where yield of rice would decrease 7.34% in the short-run and 13.33% approximately in the long-run with an increase of 1°C in temperature and 10% decrease in precipitation for instance. The results suggested that the efficiency of land, water and fertilizer use practices should be modernized through the strategies of adaptation and mitigation in new emerging policies. It is deduced from the study outcomes that government may take part by monitoring climate change and additionally very keen focused to agriculture productivity. A well-defined planning and sagacious policies will play adaptation production practices of the Rice growers. New hybrid and climatic resistance controlled crop varieties may be introduced. Newly emerging crops may be introduced which have ability with higher heat and malnourishment tolerance will help falling potential concerns. Lastly, the government could organize irrigation with other advance projects. The high temperatures region and inadequate irrigation system need the accessibility of modern irrigation technologies may well increase agricultural productivity. Therefore, adaptation and mitigation strategies may overcome the situation and less or more face the climate change constraints.

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