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Cointegration between Modern Agricultural technology and Farm Productivity in Pakistan. A time series analysis

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Abstract:

This study investigated the impact of modern agricultural technology on farm productivity and cropping intensity after adoption of modern agricultural technology. Time series data were used from 1972- 2014 for empirical analysis collected from economic survey of Pakistan and Pakistan Bureau of statistics. ARDL technique was applied for checking Cointegration among variables. Cointegration results indicate that long run relationship exist among dependent and independent variables. Results show that modern technology has positive effect on production of wheat in long run and but in short run only tube well shows negative effect in short run relationship with production. The finding of this research study reveals that lack of credit facilities and insufficient extension services are the major

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problem that needs solution for crop protection's measures and crop productivity. It is recommended that proper financial support may be given to the poor farmers by the government so that the farmers may be able to buy the equipments and increased their output.

Key words: Production of Wheat, Tractor, Tube well, Fertilizer, Water Availability, ARDL.

1. INTRODUCTION

The agricultural technology adoption importance in the ending of poverty and food insecurity, Pakistan is an agricultural country. Agriculture sector is the backbone of economy of Pakistan. The share of agriculture to Pakistan economy is 2005208 PKR Million in 2016 in average from 2006-2016 which reached to its all time high of 2210647 PKR Million in 2015. In Pakistan 43% of the labor force employed in this sector. In Pakistan the Punjab is the agricultural province where wheat and cotton are grown the most. In the past, old tools of agriculture were used and a traditional type of farming was existed everywhere, the production was very low. But now days due to the implementation of modern agriculture technology, agriculture has become an industry.

In most of the developed countries agriculture play a vital role in the development due to modern agriculture technology. The introduction of modern agriculture technology has accelerated the agriculture production to a great extent, this increase in the productivity has not only brought economic stability but it has also caused changes in the social structure. The modern agriculture technology which is used in Pakistan is not of the level that is used in the developed countries, but it has good results also.

People in Pakistan are trying to adopt new equipments of modern agriculture technology, new seeds and fertilizer,

insecticides and pesticides and it has helped in the increasing of agricultural production, which has direct impacts on the economic condition of the masses. For all counties of the world Social and economic development is one of the primary needs and is today closely linked with the study and utilization of machines and technology. due to the implementation of modern agriculture technology change has occurred in the economy, practices of day to day life, traditions, ceremonies and the whole social structure of Pakistani society, considering the importance of these thing in our life, the present study is and effort in the direction to see the impact of modern agriculture technology on the farm productivity.

Adoption of improved agricultural practices is prerequisite for agricultural development. Development presupposes among other thing transformation in land cultivation methods. John miller (1968) also pointed out that the adoption of new technology and implementation of the necessary programmers are pre-requisites of technological change in agriculture. He states the incentive system encourages the acceptance of innovation, a set of improved production processes created for local conditions, and education system to reach the farmers how to choose and adopt technology to specific conditions and efficient supply to farmers of added inputs in which technological change is embodied.

Adoption of improved farming practices by the farmers is the only mean of increasing production. Increase in production result in higher incomes to the farmers. Lower real prices of agricultural products to consumers and overall growth in national economy. Therefore, the adoption of improved gram cultivation practices is essential to increase production in the country.

Adoptions of improved agricultural practices do not occur at once. Roger concluded that farmers mostly educate, young- landlord adopted in improved practices much earlier

than the non-educated and tenant farmers because they not only have more land and physical resources at their disposal but also have thorough contact with range of information. On the basis of their adoption behavior-farmers are categorized into 5 groups. (a) Innovators (b) early adopters (c) early majority (d) late majority (e) laggards.

(Swanson (1984) Adoption is a process of mental behavior on which the individual can passes from its first hearing to the process of its final adoption. His study shows that items such as geographical distribution-social-cultural-personal factors are responsible for major problems in the adoption of improved practices .Lion Berger (1968) argues that due to the differences among individuals regarding their social-cultural economic and environmental condition-individuals differ in accepting or rejecting new ideas. It is observed that education age and attitudes of the individuals have great bearings on the adoption behavior of the respondents.

Motivation

Pakistan is an agricultural country. Its 43% of total population directly or indirectly depend upon on agriculture. it is consider as the back bone of Pakistan. government has also reduces taxes on agricultural products, providing loans for the use of modern technology in agricultural sector, but still agricultural production is reducing day by day. Pakistan is importing its basic food items from other countries. The prices of sugar, wheat, etc are increasing day by day. Not only has this shortage become a biggest crisis for the government of Pakistan. What is the reason behind this factor is becoming obstacle in the way of agricultural development. All these things become the reasons of taking the study under considerations.

2. REVIEW OF LITERATURE

There exists a rich literature on impact of modern agricultural technology on farm productivity various dimensions have been discussed in various researches. But keeping in view the objectives of the study some of the important literature has been reviewed and mentioned as given below.

Khan, (1984) Argued that the tractors ownership is increased in large scale in Pakistan since the last sixties. However, there had no positive effect of tractors cultivation on yield of various crops**.** Tractor owners of tractors need to increase landholding size which they have for cultivation and during improved land lease and self crop growing of land formerly tenanted. The concentration of cropping was found higher in those fields which had more access to fertilizers, pesticides and irrigation water sharecropper, on landlord's estates, were moderately in a weaker place as the introduction tractors had abridged the demand for their manual labor as well as their bullock labor. Tractor farms had superior private income and the practice of tractor work hire was increasing the scope for investment in tractor.

Ngascongwar (1991) Argued that modern technology of agriculture is significant in condition of increased effectiveness and drudgery alleviation. according to the study even though sub-Saharan countries, including Tanzania, recognize the importance of science and technology in the enhancement processes, they have not so far backed up this assurance with financial and other resources innovations in agricultural technology comprises of such as high yielding varieties, fertilizers, herbicides, oxidization, automation and irrigation. The study explored that the purpose of these innovations in Tanzania is not common, and for this reason their efficacy is negligible. This has been compounded by severity measures under structural modification programmer, which focus on

short-term objectives and goals. The study suggests there is a need to develop and nature indigenous scientific and technological development in order to achieve socioeconomic renovation.

Ellis and Wang (1997) found that since 1000 AD to the 1950s, farming equipment mostly not changed, as did the yields of rice, wheat and other crops. At a standstill, in general production of grain and net agricultural farm income improved at passage of time, as a result of increase several crop, prolonged mulberry/silk manufacture, and the intensified use of natural fertilizers. Lack of undignified soil resources, permanent rigorous arable farm administration sported dietetic and other requirements of rural inhabitants, which grow to recently 10 people/hec of cultivated land by the 1930s. Environmental restrictions to human carrying capacity that seem apparent in the min-1800s appear to have been overcome since the 1960s by chemical nitrogen subsidy of agro ecosystems. The report shows that these high inputs and/ or other agricultural technologies will continue to sustain food self sufficiency for the local farmers.

Hanchate & Ramswam (1997) concluded that the increase of latest agricultural technology has affected rural wages in India since 1960s;. This effect has a considerable disagreement on nature. The present prose has identified this predicament in a demand-supply framework-with a rise in agricultural earnings ascribe to enlarged labor demand caused by this technology change, and sluggish or falling wages accredited to labor supply growth outstrip labor demand. This issue is reconsidered here in a customized structure within a competitive demand-supply framework sensitivity of yields to timing of farm operations is added. In common information that misses timing can cause significant yield loss. In a competitive labor market this causes superior irritation on the farmer's art. The farmers are enthusiastic to pay a higher wage rather than

risk loss of yield. As newer machinery crops tend to be more time sensitive, this put an upward stress on wages.

Rahman et al. (1998) conducted a study in Bangladesh and Japan to explore the situation of agriculture with respect to:

1) Technology adoption and utilization of fertilizers/manures, pesticides, HYVs, improved farm practices/machines and the management of irrigation water.
2) Farmer's responses to selected environmental problem issues in agriculture.
3) Technologies/practices used by farmers to mitigate environmental problems and considered as sustainable for future use.
4) Farmer's perceptions of their own responsibilities to minimize environmental problems and attain sustainability in agriculture. Data were collected during July and august 1996 in shutiakhali village, mymernsingh district, Bangladesh and napkin block, swami chow, shaman prefecture, Japan. the paper concluded that both courtiers have environmental problems, although the types and intensities differ. Recommendations are mad for a more sustainable agriculture at both sites.

Shampire (1998) studied the function of information in the implementation of new technology, focus on the information externalities when non-adopters watch adopters in order to collect information. A Bayesian model of collective adoption is derived and the social planers association to the model is disused. The fact that the information externality is uncompensated suggests that too little adoption may occur. The social planers problem is solved numerically, signifying fast

learning on the part of adopters and a limited ability for the social planer to pay off for the information externality.

Lei Singer (2000) argued that increasing population and diminishing resources has base threatened the food security in coming scenario which is a sign for think. No easy solutions to increase food production are in sight since arable and resources are more or less exploited. The production determinations have to be enhanced through modern agricultural technology and technical innovation.

Shivalingiah et al. (1999) conducted study (n=169 farmers), in the central dry zone of Karnataka in 1998, revealed that a high percentage of farmers have adopted improved practices like improved varieties, seed rates and FYM application for various crops. However, most of the farmer's have not adopted practices like seed treatment, spacing, application of recommended NPK fertilizers as basal dose and top dressing and plant protection measures to control pest and diseases. Irrespective of the crops grown, farmers have not used herbicides to control weeds and identified lack of irrigation sources, erratic supply of electricity, pests and diseases and lack of knowledge as major production constraints.

Soni et al. (2000) concluded a research in India somewhere in district sagar of Madhya Pradesh. The main purpose of that study is to determine the constraints to the farmers for the adoption of new modern technologies. The data were collected by interviewing 100 farmers under the lab to land program. In general, the results concluded that there was positive association between the socioeconomics characteristics of the farmers and the amount of implementation modern technologies. The study also concluded that lack of information was to be foremost constraint in acceptance of enhanced varieties of crops and plant safety measures. As far as fertilizer application was considered the majority of the farmers

expressed that the main reason for non adoption of fertilizers was that level of high cost of fertilizers for these poor farmers.

3. METHOD

We applied annual time series data for our present study from 1972-2014 for Pakistan to examine the relationship between Wheat and other variables. Data have been obtained from different sources. The main sources are Economic survey of Pakistan (various issues), Pakistan Bureau of statistics, the variables used in present study are Maize, Fertilizer, water availability, tube well and Tractor.

$$\Delta WHEA_T = \beta_O + +\beta_1 FERT_t + \beta_2 WATAV_t + \beta_3 TUBW_t + \beta_4 TRAC_t + \varepsilon_t \quad (1)$$

Where
WHEA is Maize;
FERT is Fertilizer;
WATAV is Water Availability;
TUBW is Tube well;
TRAC is Tractor;

3.1 Auto Regressive Distributed Lag (ARDL) Approach

In order to examine the integration intensity as well as facts stationary, Autoregressive Distributive Lag (ARDL) approach has been used to estimate the short run and long run relationship among these variables. We used this test because it is more reliable than any other co integration approach for testing the non stationarity of series data. A variable is defined to be stationary which have constant mean and variance with respect to time. The Auto Regressive Distributed Lag (ARDL) technique was mainly developed and popularized by Pesaran and Shin (1995, 1998),Pesaran (1997); Pesaran and Smith (1998), This Auto Regressive Distributed Lag has certain advantages over the other co-integration techniques. Co-

integration defines the variable link between non-stationary process and long run equilibrium. If a variable is non stationery it requiring to be stationary at level or first order difference or both that may be like to achieve stationary which is I(0) or I(1),but if not that cannot be applied if the variables are integrated of order I (2) . The possibility to combine I (1) and I (2) variables is great advantage as financial time series are habitually stationary at level or first difference. Here we have in hand are three type of regression form of unit root ADF test for every time series data.

Without intercept (c) and trend (t): $\Delta y = \delta y_{t-1} + u_t$

With Intercept (c): $\Delta y = \alpha + \delta y_{t-1} + u_t$

With Intercept (c) and trend (t): $\Delta y = \alpha + \beta T + \delta y_{t-1} + u_t$

Here are some equations in which each one have its own critical values which depends on size of sample and in every case their null hypothesis will be are

$H_0,\ \delta = 0$

$H_0,\ \delta \neq 0$

The rules of decision for null hypothesis to be accepted or rejected are:

Calculated value of t- statistic if greater than the confidence interval critical value in that situation we will not reject the null hypothesis, it means that a unit root exist.

And on the other side when the calculated value of t-statistic is smaller than the critical value then in that case we will reject the null hypothesis and that mean there is no unit root exist.

This approach can be applied as well for series that have diverse orders of Integration while for other techniques similar integration order is necessary for Engle Granger residual based co-integration or Multivariate Johansen co-integration approach. In order to completely overcome the lag effect of dependent and independent variables ARDL model

requirement allows flexibility to include mandatory numeral of lags required to illustrate dynamic behavior of the dependent variable. The ARDL technique is also useful for even the sample size of data is small because it provides consistent and good outcome for small sample size (Adom et al 2012). In order to examine the association among the variables which we selected and Maize production kg/hec for Pakistan, the ARDL technique is applied, which is defined in equation as follows.

$$\Delta WHEA_T = \beta_O + \sum_{t-1}^{w} \beta_1 i \Delta WHEA_{t-1} + \sum_{t-1}^{w} \beta_2 i \Delta FERT_{t-1} + \sum_{t-1}^{w} \beta_3 i \Delta WATAV_{t-1} + \sum_{t-1}^{w} \beta_4 i \Delta TUBW_{t-1} + \sum_{t-1}^{w} \beta_5 i \Delta TRAC_{t-1} + \beta_6 i \Delta WHEA_{t-1} + \beta_7 i \Delta FERT_{t-1} + \beta_6 i \Delta WATAV_{t-1} + \beta_6 i \Delta TUBW_{t-1} + \beta_6 i \Delta TRAC_{t-1} + \varepsilon_t \quad (2)$$

From equation (2) Δ is the first operator of difference, β_0 shows constant ε_t is the error term. In the initial part of the equation with constraint β_1 *to* β_5 shows us the error correction dynamics along with other part from β_6 *to* β_{10} shows long run relationship of the model. To check the long-run relationship among dependent variable wheat and independent variables that are tube well, tractor, fertilizers and water availability the procedure of F-test is followed for the significance of coefficient of variables. The present study has the following hypothesis which is tested. $\{H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0\}$ against $\{H_0 : \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0\}$. The null hypothesis non rejection shows us that there exists long run relationship. The upper and lower critical value for F-statistic all variable are I (0) for lower bound and all variable are I (1) for upper bound. If the results of F-statistics cross the upper critical value then there is the evidence of co integration relationship among variables irrespective of the orders of integration of variables. On the other side if the t-statistic falls below the critical bound then the null hypothesis cannot be rejected of no co integration. Though if the calculated value of t-statistic drops among upper and lower values at that time the result will be uncertain. Then

the short run dynamics are then estimated through ECM as follows.

$$\Delta WHEA_T = \beta_O + \sum_{t-1}^{w} \beta_1 i \Delta WHEA_{t-1} + \sum_{t-1}^{w} \beta_2 i \Delta FERT_{t-1} + \sum_{t-1}^{w} \beta_3 i \Delta WATAV_{t-1} + \sum_{t-1}^{w} \beta_4 i \Delta TUBW_{t-1} + \sum_{t-1}^{w} \beta_5 i \Delta TRAC_{t-1} + \eta_1 ECT_{t-1+} \varepsilon_t \quad (3)$$

In the above equation (3) ECT_{t-1} represent the error correction term obtained from the model of co integration. These are the error coefficients ($\eta_{1,}$)which indicates that at which speed the co integration model adjust its previous disequilibrium or the velocity of change to reinstate the long run equilibrium relationship among the variables. The significant negative ECT_{t-1} coefficient means that any movement of short run among dependent and independent variable coverage will back to the long run relationship.

4. EMPIRICAL RESULTS AND DISCUSSION

Table 1.Unit root test results

ADF			**PP**	
Level				
Variable	Intercept	Trend and Intercept	Intercept	Trend and Intercept
WHEAT	-0.3092(0.9145)	-7.8615(0.0000)	-0.5944(0.8610	-7.8615(0.0000)
FERT	2.0209(09998)	-6.7735(0.0000)	-0.7495(0.822)	-3.8744(0.0221)
WATAV	-1.4983(0.5245)	-1.6111(0.7712)	-1.0842(0.713)	-2.3289(0.4099)
TUBW	-0.2102(0.9291)	-2.0134(0.5768)	-0.2868(0.918)	-1-7202(0.7245)
TRAC	0.6248(0.9887)	-0.6744(0.9682)	0.2028(0.9696)	1.1248(0.9125)
First Difference				
WHEAT	-8.224 (0.0000)	-8.1110(0.0000)	-37.2054 0.000	-35.5960 (0.0000)
FERT	-6.9546(0.0000	-7.6256(0.0000)	-3.8265(0.005)	-3.6304(0.0394)
WATAV	-10.3403(0.000)	-10.4665(0.0000)	-10.3403(0.000	-11.1986(0.0000)
TUBW	-4.5456(0.0007)	-4.4830(0.0048)	-4.4930(0.008)	-4.4274(0.0055)
TRAC	-5.4317(0.0001)	-5.6201(0.0002)	-4.6017(0.006)	-5.6086(0.0002)

As first step, the likely non stationary concerned was superscribed employing ADF and PP test. Even though the ARDL does not necessitate prior checking of unit root issue, in the analysis is necessary to carry out this test to determine that variable does not have unit root problem and also their order of

integration is not more than one. Table 1 report the Augmented Dickey-fuller and Philip pesaran unit root test results. The ADF and PP unit root test were applied on two sets, being intercept and intercept with time trend. The result shows that variables which used in the study are non stationary at level but in first difference they become all stationery at level and intercept. The value order of all these are not more than one which is a good sign important and for long run co integration analysis.

Table 2. Lag length selection criteria for Co integration

Lag	Log L	L R	F P E	A I C	S C	H Q
0	-1655.668	NA	7.92e+29	83.03340	83.24451	83.10973
1	-1471.354	313.3343*	2.78e+26*	75.06768	76.33434*	75.52567*
2	-1446.390	36.19719	2.96e+26	75.06950	77.39171	75.90914
3	-1418.947	32.93141	3.09e+26	74.94736*	78.32512	76.16865

Second step for co-integration is to check the lag length selection criteria for ARDL model. The above table indicates the results of lag length selection criteria through different test. AIC and SC is the mostly used by researchers. According to AIC lag one is the best lag length for ARDL however SC is significant at lag three.

Table 3. Diagnostic Tests for ARDL Approach

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.784909	Probability. F(7,34)	0.6046
Obs*R-squared	5.842944	Probability. Chie-Square(7)	0.5582
Scaled explained SS	3.391481	Probability. Chie-Square(7)	0.8466

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.021553	Probability. F(2,32)	0.9787
Obs*R-squared	0.056501	Probability. Chi-Square(2)	0.9721

To check the consistency of the models, the following diagnostic tests of serial correlation and Heteroskedasticity were applied in the error term. The result of the above test suggests that there is no proof of serial correlation in the data. The model

Breusch-pagan-Godfrey test implying that there is no heteroskedasticity and the errors are normally distributed. Therefore it is reasonably to state that the model is well behaved, because the p-value of both tests is more than.05% level of significance. Estimated results of co integration between wheat production and different economic variables in Pakistan using ARDL technique are presented; the estimated results are given below.

Table 4.Bound test for co integration

T- Statistics	**Value**	**Outcome**
FWeat(Weat/Trac,Tubw,Fert,Watav)	9.293693	Co-integration
Critical Bounds Values		
Significance	I(0) Bound	I(1) Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

The table 4 above shows the bound test result for co integration. Our estimated outcomes exposed that there exists co integration between dependent and independent variables at 10, 5 2.5 and 1 % level of significance it is for the reason that the calculated F-statistics value is more than the upper bound value of critical bound values.

Table 5. Short Run ARDL Model

Dependent variable Wheat				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(WATER_AVA)	1.572551	5.332104	0.294921	0.7698
D(TUBEWELL)	-0.000113	0.000455	-0.248973	0.8049
D(TRACTORS)	0.002781	0.001702	1.633516	0.1116
D(FERTILIZER)	0.054947	0.062134	0.884343	0.3827
ECM(-1)	-1.205769	0.169973	-7.093884	0.0000

The above table 5 shows the results of short run coefficients of ARDL. Results of short run ARDL shows that the coefficient of fertilizer has positive and statistically insignificant impact on

wheat for Pakistan. Coefficient of fertilizer indicates that 1 % increase in fertilizer increase wheat production up to 0.5 % kg/hec in Pakistan. Tractor co efficient shows positive and statistically insignificant on wheat production in Pakistan. Co efficient of tractors indicates that when the 1 % change in number of tractors increase it positively affect the production of wheat and increase in production up to 0.2 % kg/hec in Pakistan. Tube well co efficient shows negative effect and statistically insignificant impact on production of wheat. Co efficient of Tube well shows that 1% increase has negative impact on wheat production and decrease wheat up to 0.001 %. Co efficient of water availability shows positive effect and statistically non significant impact on production of wheat and indicates that 1 % increase in water availability increase maize production up to 15.72 % per annum increase in Pakistan.

Table 6. LONG RUN ARDL Model

Dependent variable Wheat				
Variable	**Co-efficient**	**Std. Error**	**t-Statistic**	**Probe**
WATER_AVA	10.173564	2.143571	4.746082	0.0000
TUBEWELL	0.000550	0.000147	3.731557	0.0007
TRACTORS	0.002306	0.001383	1.667086	0.1047
FERTILIZER	0.045570	0.050306	0.905874	0.3714
C	380.346793	176.428888	2.155808	0.0383

The table 6 shows the results of long run ARDL based on akaike information criterion. We used wheat as dependent variable and fertilizer, tube well; water availability and tractor are used as independent variables or explanatory variables. The following results appear from the above table. The estimated coefficient of fertilizer shows positive effect on wheat and statistically insignificant at 5% level of significance. Fertilizer coefficient indicates that 1% increase in Fertilizer may increase production of wheat up to 0.4% kg/hec. Second coefficient of tractors is positive and statistically insignificant indicating that 1 % increase in unit of tractors may increase

wheat production up to 0.2% kg/hec. The results of (Khan et al 1984) also same with me he concluded that tractors have positive impact on wheat. The estimated coefficient of tube well shows positive effect on wheat production and also statistically significant at 5% level of significance. It means if we increase the number of tube well by 1% that will increase the production of wheat by 0.05% kg/hec.

The last variable in our study is water availability. The coefficient of water availability shows positive effect on wheat and also statistically significant at 5% level of significance. It means that if we increase irrigation system in our country by 1 % it may increase the production of wheat up to 100.1 %kg/hec. Dehghanian et al. (1999) evaluated the economics of agricultural production systems of the Khorasan province, Iran, by using cluster-sampling method. The results showed that water as the most limiting factor in the province.

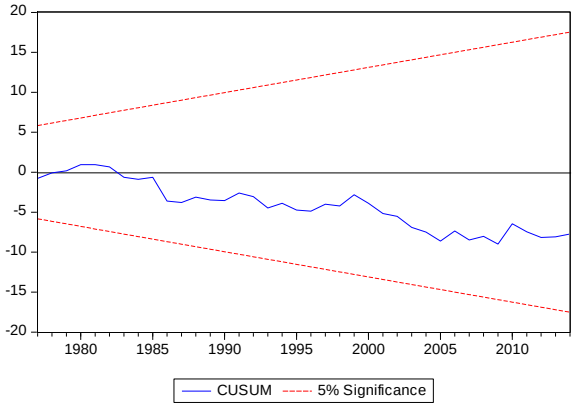

Figure 1. Plot of cumulative sum of squares of recursive residual (CUSUMSQ)

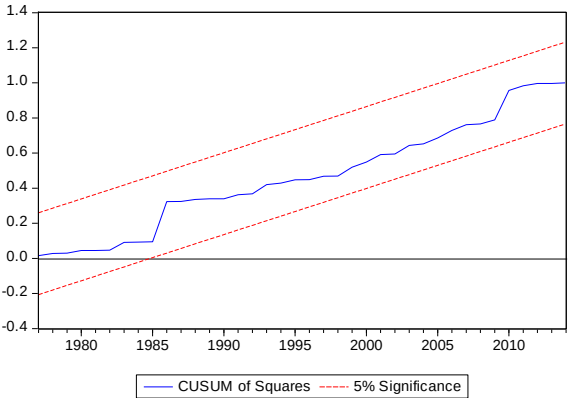

Figure 2. Plot of cumulative sum of the recursive residuals (CUSUM)

At the end the stability of the estimates was assessed by employing the cumulative sum (CUSUM), of the recursive residuals and the cumulative sum of squares (CUSUMSQ) of the recursive residual test. Figure 1 and 2 provides plots for the above tests correspondingly. These Figures specify that CUSUM and CUSUMSQ test statistics, might not exceed the limit at five percent of level of significance as a result model appears to be stable.

5. CONCLUSION AND RECOMENDATIONS

The present study employed ARDL technique to capture the impact of different inputs on yield of maze, for Pakistan during period from 1972-2014. The dependent variable is maze and independent variables are no of tractors and tube wells fertilizer and water availability. This shows that the modern technology has significant impact on production of Maize. But in short run tube well has negative results showing that there is certain reason for that which are non availability of electricity and high prices of oil due to which it shows negative effect. In long run water availability shows negative effect on Maize production which is caused by different factors one of the

dominant factor is seasonal variation in weather because in Pakistan there are mostly land are not irrigated. No such irrigation system is planned. In face of the above conclusions, the study put forward for the following recommendations. Proper financial support by the government may be given to the poor farmers, so as they can buy the modern equipments. Farmers education is one of the most important factor to achieve specific objective. The government should be willing to invest public funds in research and development and encourage the private sector to follow the same sector. Providing technology facilities to every farmer so they could improve their output, economic and social meetings with farmers to identify their needs use of the technology characteristics and to provide services to these needs

REFERENCES

1. Din, M. J. U. "The socio-economic problems of small farmers in adopting new agricultural technology a case study of three villages in district Mardan." *Sarhad J. Agric* 27, no. 2 (2011): 299-304.
2. Ellis, ECy, and S. M. Wang. "Sustainable traditional agriculture in the Tai Lake Region of China." *Agriculture, Ecosystems & Environment* 61, no. 2-3 (1997): 177-193.
3. Hanchate, Amresh D., and K. V. Ramaswamy. "New agricultural technology, timeliness and wages for labour: a longitudinal study of rural wages in India." *Applied Economics Letters* 4, no. 4 (1997): 267-270.
4. Khan, Mahmood Hasan, and Ijaz Nabi. "Agricultural Policy Issues in Pakistan [with Comments]." *The Pakistan Development Review* 23, no. 2/3 (1984): 241-255.

5. Leisinger, Klaus M. "Population growth, food security, and civil society: the hunger problem can be solved." *D+ C, Development and Cooperation* 1 (2000): 8-12.
6. Miller, Edward J. "Technology and regional development: a survey." *International regional science review* 8, no. 2 (1983): 89-125.
7. Ngasongwa, J. "Agricultural technology and producers: the Tanzania case." *Uongozi* 4, no. 2 (1992): 440-462.
8. Rahman, M. Z., H. Mikuni, and M. M. Rahman. "Towards Sustainable Agriculture The Impact of Technology Adoption for Agricultural Development." *Economic Affairs (Calcutta)* 43, no. 3 (1998): 135.
9. Schuster, Darleen V., Thomas W. Valente, Silvana N. Skara, Made R. Wenten, Jennifer B. Unger, Tess Boley Cruz, and Louise Ann Rohrbach. "Intermedia processes in the adoption of tobacco control activities among opinion leaders in California." *Communication Theory* 16, no. 1 (2006): 91-117.
10. Shampine, Allan. "Compensating for information externalities in technology diffusion models." *American Journal of Agricultural Economics* 80, no. 2 (1998): 337-346.
11. Soni, S. N., R. K. Pathak, and R. R. Kashikar. "Socio-economic study to analyse constraints in adoption of modern technology by various socio-economic groups in district Sagar (MP)." *Crop Research (Hisar)* 19, no. 2 (2000): 353-356.