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Parametric Analysis of Rice Crop Technical Efficiency and Technological Change of four Provinces of the Pakistan. (A Stochastic Frontier Analysis Approach)

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Abstract

The purpose of this study is to find out the factor which affects the efficiency and productivity of the rice crop of the four provinces of Pakistan. The study analyzed the total factor productivity of rice crop of the four provinces during the period 1980-2018.The study examined the impact of different inputs on the rice production as well as the effect of inputs efficiency and technological change on the rice production. The study used panel data and labour, arable land, irrigated land, petroleum consumption, electricity, fertilizer, credit availability, no of tube well, water availability and literacy rate were used as inputs. The study applied parametric stochastic frontier analysis technique and used Battese and Coelli model (1992, 1995). The study used stata 14 for the analysis of data. The study found that literacy rate, petroleum consumption, electricity consumption, credit availability; water availability, fertilizer and number of tube wells have significant effect on the rice production. The study found technological change effect on rice crop where time trend (years) used for technological change while time varying technical efficiency score gaps among the four provinces have been found in rice production, which were 88%, 82%, 81% and 51% for Punjab, Sindh, Balochistan and Khyber pukhtunkhwa respectively. The study suggested that to improve total factor productivity of rice crop of Pakistan and its

provinces then government should give due attention to the use of modern technology, as well also transfers technology and resources to all provinces equally. One of the other factors which will be helpful in crops productivity growth is improvement in the management practices in order to increase the efficiency of the inputs used in the process of production. To obtain the gains in the inputs technical efficiency change more emphasis should be given to information and knowledge rather than the conventional inputs such as water fertilizer etc.

Key words; Stochatic frontier analysis, technical efficiency change, technological change

Background and Importance

The function of agriculture is important in generating economic growth directly and indirectly. The importance of agriculture can be seen in different ways; firstly it is source of food for consumers and fibers for domestic industries, secondly; foreign exchange earnings is obtained by this sector; and lastly it is source of industrial goods market. Agriculture plays a very important function in the progress of the countries. Pakistan is an agriculture based country, as well as its agricultural sector is its economic driver. Agriculture plays a very important function in the progress of the countries. Pakistan is an agricultural country and agricultural sector is backbone of the Pakistan economy. The contribution of agriculture sector is 18.5% of the gross domestic product and employing 38.5% of the labor force and also huge source of raw material for many agro based industries in Pakistan. Agriculture productivity growth is one of the main research subjects that are examined by the development and agricultural economists to uncover differences between regions and nations in terms of their growth rate of productivity. The concept of productivity growth in the agriculture sectors important because steady increase in the population is one of problem which is faced by many less developed countries, so the output must grow at rapid rate in order to fulfill the demands of foods & other materials. Different researcher examined TFP(total factor productivity) and its two components “efficiency change and technological change” such as Ali and Hamid (1996), Mao and Koo (1996, Fernandez and Shumway (1997) , Ahmed (2001), Sigit (2002), Coelli and Prasada Rao (2003), Ali (2004), Bhushan (2006) , Tipi and Rehber (2006), Abedulah et al (2007), Lambarra et al (2007), Kiani et al (2008) ,Edirisinghe and Withanage (2011),).Majiwa (2017), Mitra and Yunus (2018).To estimate the effect of different inputs on the total factor productivity growth they used MPI(Malmquist

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productivity Index) and SFA(stochastic frontier production function). There are two types of distinct crops seasons, one is Kharif and other is Rabi crops because of annually changes in the temperature of Pakistan. Generally Kharif crops have been sown during April - June and harvested between Octobers to December. While Rabi crops have been sown during October to November and harvested between April to May. The Pakistan cropping system changes because of variations in the agro-climatic and soil situation. During each season different crops production are varied due to the nature of soil and climate conditions as well as on the availability of resources. The principal crops of Rabi are Wheat, gram, Rape and mustard seed while main Kharif crops are rice, maize, cotton, millet, sorghum and sugarcane.

Rice:

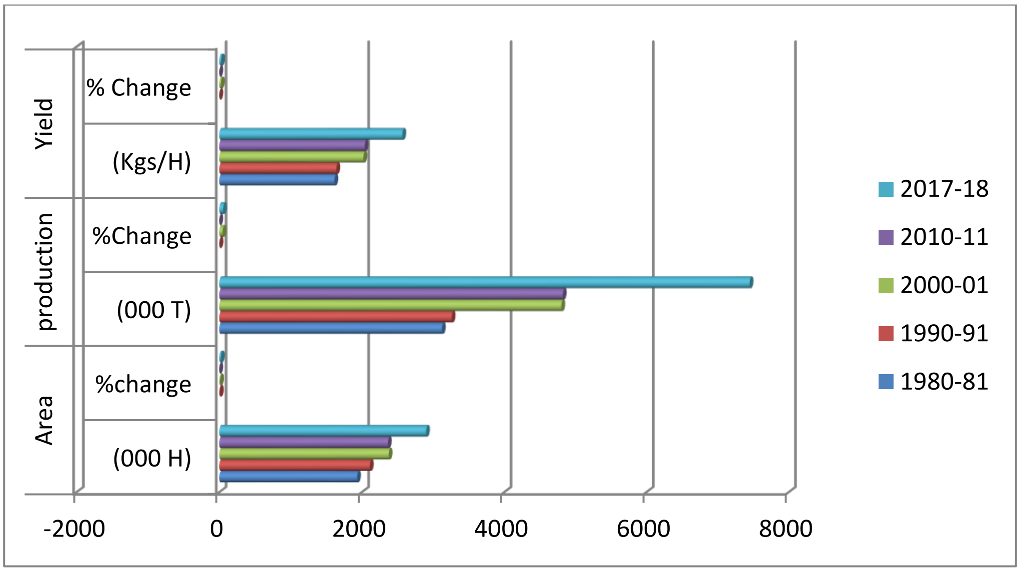
Pakistan's important food and cash crop is rice. This is second most important attach food crop after wheat and after cotton it is second major exportable commodity. During period 2017-18 cultivated area under rice crop increased by 22.63 % to 2900.6 thousand hectares as compared to 2365.6 thousand hectares during the previous decade 2010-11. The production of the rice was7449.8 thousand tones s and reached historically at high level and rerecorded an increase of 54.45 % over the production of previous decade 2010-11. In agriculture, value added share of rice is 3.1% and its share in Pakistan’s GDP is 0.6 %. Rice cultivation became attractive for growers, due to good domestic prices, availability of inputs on subsidies prices and increase in export with good planning. The area, production and yield of the rice is shown decade wise in the table and figure below from 1980-81 to 2017-18.

Table No 1: Area, Production and yield of Rice Decade wise (1980-81 to 2017-18)

Year	**Area**		**Production**		**Yield**	
	(000 H)	**%change**	**(000 T)**	**%Change**	**(Kgs/H)**	**% Change**
1980-81	**1933.1**		**3123.2**		**1616.0**	
1990-91	**2112.7**	**9.29**	**3260.8**	**4.39**	**1643.0**	**1.6**
2000-01	**2376.6**	**12.49**	**4802.6**	**47.28**	**2021**	**23**
2010-11	**2365.3**	**-0.47**	**4823.3**	**0.43**	**2039**	**0.89**
2017-18	**2900.6**	**22.63**	**7449.8**	**54.45**	**2568**	**25.94**

Source: Pakistan Bureau of statistics

Figure No.1: Area, Production and yield of Rice Decade wise (1980-81 to 2017-18)



Research objective

1. To measure the impact of the conventional and non-conventional inputs and it efficiency on the rice crop of Pakistan's provinces during the period 1980- 2018.

2. To measure efficiency score and to check technological change effect on the output of the rice crop of Pakistan's provinces.

$H_0$1: Technological change has no impact on the rice production of Pakistan's provinces

$H_0$2: provinces of Pakistan have no technical efficiency gaps in the rice production.

3.1. Sample size

The study is conducted on the rice crops of Pakistan's provinces and used using panel data ,to examine the effect of different conventional and non convention inputs on the rice crop of Pakistan's four provinces i.e. Punjab, Sindh, Khyber pukhtoonkhwa during the period (1980-2018).

3.2. Variables, Data Collection and Procedure

The study used conventional inputs labour, total arable land, non-conventional inputs such as use of electricity in agriculture sector, use of petroleum product, education(rural literacy rate as proxy), irrigated land, water availability, credit availability, fertilizer, no of tube wells. The data will be collected from various Government agencies, economic survey of Pakistan, bureau of statistics, Ministry of Food, Agriculture and lives stock, Pakistan agriculture research council etc.

Concepts of TFP change; Technical efficiency change (TEC), technological change (TC).

This paper defines the notions of TEC, TC, and TFP using the TE idea that was previously described. The explanations from Sun and Kalirajan (2005) are used to explain those ideas in Figure 24. Actual productions during times t and t+1 are represented by points A and B in Figure 24, respectively. The production frontier at periods t and t+1 is referred to as PPt and PPt+1, Levels of input and output, x and q respectively. It is possible to break down the output growth caused by the switch from A to B (Qt+1 - Qt) as follows.

Increasing output equals Qt+1 - Qt = AC + CD + FB

$$= AC + CD + (EF-EB)$$

$$= (AC–EB) +CD+EF$$

= [(Q*t,t-Qt) - (Q*t+1,t-Qt+1)] (Q*t+1,t+1 - Q*t,t+1) + (Q*t,t+1 - Qt,t) - Q*t,t+1) Technical inefficiency is measured at period t by (Q*t,t - Qt) and at period t+1 by (Q*t,t+1 - Qt+1). Assuming the same quantity of input (Xt) but differing production technologies (PPt and PPt+1), (Q*t,t+1 - Qt,t) assesses TC. (Q*t+1,t+1 - Q*t,t+1) evaluates how much input growth (from Xt to Xt+1) contributed to output growth at period t+1's technological level. In essence, the output growth is broken down as: Growth in output equals (TEC's contribution) plus (TC's contribution) plus (Contribution of input growth).The remainder is TFP's contribution to output growth after subtracting input growth's contribution from output growth. According to this, TFP can be divided into two parts: (a) TEC, and (b) TC. In other words, while TC denotes an upward movement in the production frontier, TEC indicates a narrowing of the gaps between maximum (theoretical) and maximum (actual) production on the frontier at the same input level. These two elements together make for TFP growth.

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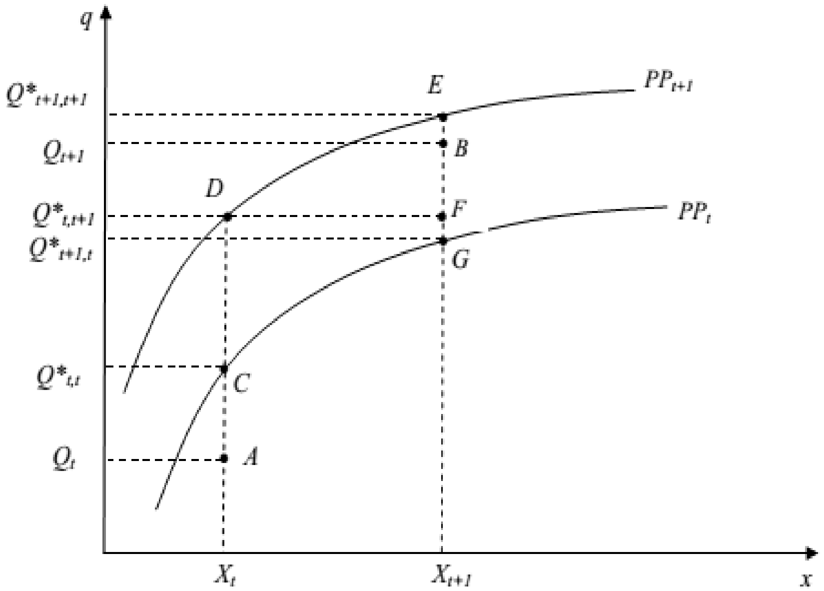
Figure.No.2.TFP change Technical, efficiency change (TEC), technological change (TC)



Methodology and procedure

This paper used stochastic frontier analysis for the data analysis which is parametric technique. Maximum likelihood estimation of stochastic frontier production is used by this method. Non negative error term is used for the estimation of technical efficiency. However for the estimation of technical changes a variable of time trend is entered into model of "stochastic frontier production", based on the assumption of Hicksian neutral technological change. The study used Battese and Coelli stochastic frontier models (1992 and 1995 version), to estimate production function & model of inefficiency. Stochastic production function is measured by stochastic frontier analysis technique where two components, random noise and technical inefficiency are obtained by decomposition of error term. Aigner and Chu (1968) introduced first time this technique in their dominant article, to measure production function for industry. Negative sign to error term in the model is used by them. Its mean real production points lay on or under the expected output border. Aigner and Chu (1968) defined this as random shock in process of production (due to costs and faulty products) and efficiency (produce unproductively).Aigner, Lovell & Schmidt (1977) further developed this technique and revised model was introduced by Meeusen and Van den Broeck (1977) and Battese and Coelli (1992). They included random error into the model which stands for statistical noise because of unintentional exclusion of appropriate variables from the inputs vector & from estimation errors. (Coelli et al. 2005). Another technical inefficiency model was introduced by Battese and Coelli (1995) which permitted evaluation of jointly, time-diverging technical inefficiencies and Technical changes in the stochastic frontier. Kalirajan and Obwona (1994) constructed stochastic varying coefficients model which is another type of stochastic frontier function. This model measures various slope coefficients and intercepts for various firms where intercept and error could not isolated from each other. Battese and Coelli (1995) model has been used in most recent researches, using stochastic frontier analysis. Stochastic frontier analysis (SFA) is more useful as compare to data envelopment analysis (DEA) because it considers random noise and also many hypotheses can be tested. However, condition of distributional form of technical inefficiency term is required by stochastic frontier analysis.

Battese and Coelli (1995) stochastic frontier production model is used by this study which also simultaneously measures Battese& Coelli (1992) model. A version of Aigner, Lovell, and Schmidt's (1977) panel data model for the stochastic frontier production function was developed by Battese and Coelli in 1992.

The stochastic frontier model in Cobb Douglas form is;

$$\ln q_{it} = x_{it} + v_{it} - u_{it}$$

Stochastic frontier productions function model in Cobb-Douglas form:

$$\ln q_{it} = B_0 + B_1 \ln x_{it} + v_{it} - u_{it} \qquad (2)$$

or or $$q_{it} = \exp(\beta_0 + \beta_1 \ln x_{it}) \times \exp(v_{it}) \times \exp(-u_{it}) \qquad (3)$$

Where q_{it} is province i output at time period t, x_{it} is inputs quantity of provinces during time period t, B stand for parameters which will be calculated. exp (v_{it}) = statistical noise or random noises, v_{it} may be minus or plus, and assumed to be normally distributed and independent of u_{it} .

β are parameters which is to be estimated.

exp ($\beta_o + \beta_1 \ln x_{ii}$) are deterministic factor.

exp (v_{it}) stand for statistical noise, v_{it} maybe negative or plus, v_{it} is random error which is assumed to follow normal distribution and independent of u_{it} and where $v_i \sim N(o, \delta^2)$ u_{it} □ (u_i exp (□□(t □T) u_i technical inefficiency such that $u_i \leq 0$ which follow a truncated normal distribution and assumed that $v_i \sim N(o, \delta^2)$ which is

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independently and identically. Exp (□u_{it}) stands for technical inefficiency. □ is a parameter to be estimated and it stands for the advancement of technical efficiency over time. The model is a time-invariant inefficiency model if □□is =0 otherwise It is a time-varying inefficiency model. Technological change (TC) can be measured by including a time trend variable in the stochastic frontier production function in equations (1) and (2). The stochastic frontier's estimated time trend variable coefficient measures the average rate of technological development. This study will apply two stages method, in first stage stochastic frontier production function & predicted efficiency change will be measured and in 2nd phase regression of predicted efficiency change will run on its independent variables. Kumbhakar.et.al (1991), Reifscheneider and Stevenson (1991) and Hung and Liu (1994) has used the same technique and conducted their research work. They used cross section data and measured stochastic frontier production and technical efficiency models. Battese and Coelli extended their (1992) model of panel data to 1995 model which explains changes in the technical efficiency of the output due to different inputs. The 1995 Battese and Coelli model explains a vector of specific variable which effect technical efficiency of a province. This model applied equation (2) Battese and Coelli 1992 model but u_{it} is treated as non negative random variable following a truncated normal distribution at zero mean $Z_{it}\delta$ and variance$\delta^2 u$. It is assumed that U_{it} is function of a set of explanatory variables as:

$$U_{it} = Z_{it}\delta + w_{it} \qquad \textbf{(4)}$$

Where Z_{it} is a vector of inputs effecting technical efficiency of provinces, δ is a vector of parameters which is to be measured. W_{it} is a truncation of normal distribution with zero mean and variance. Therefore simultaneous estimation of the parameters of the stochastic frontier production function equation (13) and (15) are used for maximum likelihood estimation (Battese and Coelli, 1995). The technical efficiency of an individual farm can be defined in terms of the ratio of the observed output to the corresponding frontier output, given the available technology, where the suggested estimation of the technical efficiency is explained by Battese and Coelli (1992) is given;

$$TE = \frac{Y_i}{Y*_i} = \frac{f(X_{i;\beta)}\exp(v_i - u_{i)}}{f(X_{i;\beta)}\exp v_i} = \exp\,(u_i\,) \qquad (5)$$

The likelihood method for the estimation of both stochastic frontier analysis and technical inefficiency was used by Coelli et al.2005.Therefore to check whether the effect of inefficiency is required or not is tested by likelihood estimation. Battese and Coelli (1992) used diagnostic test of likelihood which allows the parameters of error variance ratio knows as gamma(γ) and sigma square δ^2 expressed as $\delta^2{}_{w} = \delta^2{}_{u} + \delta^2{}_{v}$ where $\gamma = \frac{\delta^2{}_{u}}{\delta^2{}_{w}}$. Where the goodness of fit data in the model is measured by sigma square and value of gamma is lies between 0 and 1. The value near to zero or equal to zero $\gamma = 0$ means random noise effect and if $\gamma = 1$ or equal to 1 mean inefficiency effect. The γ involves in the checking of null hypothesis (H_0) that there is no effect of technical inefficiency in the provinces expressed $\gamma = 0$ and against alternative hypothesis (H_1) that technical inefficiency existing the provinces expressed as $\gamma = 1$

3.5. Model specification for the study:

For estimation of technical efficiency change and technological change of the rice crop of Pakistan's provinces, the study used time-varying inefficiency model of Battese and Coelli both 1992 and 1995 models. Battese and Coelli 1995 model combined the technical inefficiency effects model shown in equation (4) into stochastic frontier production function represented by equation (2). The stochastic frontier production of Pakistan's provinces for each important crop during the period 1980-2018 can be estimated in cobb-Douglas form with output and ten inputs such as labour, arable land, irrigated land, literacy rate, petroleum consumption, electricity consumption, credit availability, water availability, fertilizer and no of tube well can be described as:

$$\mathbf{Lny_{it} = \beta_0 + \beta_1 lnla_{it} + \beta_2 lnal_{it} + \beta_3 lnil_{it} + \beta_4 lnli_{it} + \beta_5 lnpc_{it} + \beta_6 lnec_{it} + \beta_7 lnca_{it} + \beta_8 lnwa_{it} + \beta_9 lnfe_{it} + \beta_{10} lntw_{it} + v_{it} - u_{it}} \quad \textbf{(6)}$$

Y_{it} value of one of the important crop of Pakistan's provinces at time period t. V_{it} is random noise with normal distribution N $(0,\delta^2 v)$, u_{it} is technical efficiency effects and that is non-negative following truncated normal distribution of $N(m_{it}, \delta^2 u)$. For estimation of technological change in the sub-sector of agricultural important crops of the Pakistan's provinces, a time trend variable has been added into the equation (2). Thus the final stochastic frontier production of the study is;

$$\mathbf{Lny_{it} = \beta_0 + \beta_1 lnla_{it} + \beta_2 lnal_{it} + \beta_3 lnil_{it} + \beta_4 lnli_{it} + \beta_5 lnpc_{it} + \beta_6 lnec_{it} + \beta_7 lnca_{it} + \beta_8 lnwa_{it} + \beta_9 lnfe_{it} + \beta_{10} lntw_{it} + \beta_{11} t(years) + v_{it} - u_{it}} \quad (7)$$

Where: t stands for time trend variable.

Stochastic Frontier Data Analysis of Rice Crop of Pakistan's Provinces:

The result is shown in the table no.2, where first part which is frontier production function and explains the effect of different inputs on the production of rice crop of the Pakistan's four provinces. In the table no.2 literacy rate, petroleum consumption , electricity consumption, credit availability, water availability, fertilizer and number of tube wells has significant effect on the rice production of Pakistan's provinces because their p value is less than .05 but the sign of credit availability and fertilizer coefficients are negative and shows inverse relationship . It means that 1% increase in credit availability and fertilizer could result in decrees .17% and .53% decrease in the production of the rice of the Pakistan's four provinces because the excess use of fertilizer than the required amount and for credit availability negative sign may be explained as that due to natural disaster such as floods (years1992, 2010), climate changes and high interact rate, marginal product could be decreased due to decreasing return to scale. The sign of literacy rate, petroleum consumption, electricity consumption, water availability and numbers of tube well are positive, shows positive effect or positive relationship. It means that if there will be one % increase in literacy rate this will result in 1.32% increase in rice production, because the educated person is more efficient than the illiterate. On the other hand 1% increase in petroleum consumption, electricity consumption, water availability, and number of tube well will result in increase by .067%, .25%, 1% and .52% in the rice production of Pakistan's four provinces respectively. The labour, arable land, irrigated land has no significant effect on the rice production of the four provinces of Pakistan because their p values are greater than .05. This study used time trend (years) for technological change which also has significant effect on the rice production because its p value is less than .05.Therefore the null hypothesis (H_0),that technological change has no effect on the total factor productivity of Pakistan and its provinces has been rejected. The sign of the coefficient is positive and this mean that if we increase one more year this will result .53% increase in the production of rice. The second part of the table

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no.3 (Mu) express the inefficiency model here (dependent variable is inefficiency) and we regress these explanatory variable on inefficiency where p value is greater than .05 and shows insignificant effect on the technical efficiency. Battese and Coelli (1992) used diagnostic test of likelihood which allows the parameters of error variance ratio known as gamma(γ) and sigma square δ^2 expressed as $\delta^2{}_{w} = \delta^2{}_{u} + \delta^2{}_{v}$ where $\gamma = \frac{\delta^2{}_{u}}{\delta^2{}_{w}}$. The goodness of fit data in the model is measured by sigma square and value of gamma lies between 0 and 1. The value near to zero or equal to zero $\gamma = 0$ means random noise effect and if $\gamma = 1$ or equal to 1 means inefficiency effect. For this purpose we used the value of variance of u and v which is .7347644 and .2200546 in the last part of the table. After computing γ value it is obtained 0.92 which is near to 1 and express that deviation from the production Frontier is due to inefficiency, not due to random shock and the value is lies between 0 and 1(0.92) and we conclude that the model is stochastic frontier production function and efficient model. Time varying technical efficiency has been shown in the table no.3 which is obtained by stata 14 software and used predict command. The finding shows that the mean/average efficiency score of Punjab is 88%that suggested that rice production of Punjab could be further increased by 12%.The Sindh efficiency score is 82%, Khyber pukhtunkhwa 51% and Balochistan efficiency score is 81% and could be increased by 18%, 49% and 19% respectively. The overall efficiency score of Pakistan is 75% and that suggested that production of rice crop of Pakistan further increased by 25% by eliminating the effects of technical inefficiency. Therefore we concluded that there are efficiency differences in the production of rice among the provinces of Pakistan and on finding of the given efficiency score we reject the hypothesis (H_{01}), that there is no technical efficiency gap among the provinces of Pakistan.

Table.No.2: Inefficiency model of cotton production of Pakistan's province

Inefficiency effects model (truncated-normal)					Number of obs =	152
Group variable: sno					Number of groups =	4
Time variable: years					Obs per group: min =	38
					avg =	38
					max	38
					Prob > Chi2	0
Log Likelihood = -50.9273					Wald Chi2(11)	2050.22
ly	**Coef**	**Std. Err**	**z**	**P> |z|**	**[95% Conf. Interval]**	
Frontier						
log1a	0.0567	0.2095937	0.27	0.787	-0.3541141	0.4674779
logal	0.0016	0.1363725	0.01	0.991	-0.2656789	0.2688915
logil	-0.272	0.1792118	-1.52	0.128	-0.623673	0.0788245
logli	1.3241	0.3330663	-3.98	0	-1.976858	-0.671262
logpc	0.0675	0.0290972	2.32	0.02	0.0104926	0.1245513
logec	0.2557	0.0700294	3.65	0	0.1184254	0.3929354
logca	-0.169	0.0508297	-3.32	0.001	-0.2685618	-0.0693132
logwa	1.0112	0.0717482	14.09	0	0.8705661	1.151814
logfe	-0.409	0.0996793	-4.1	0	-0.6042498	-0.2135143
logtw	0.5278	0.0895132	5.9	0	0.3524065	0.7032919
years	0.0532	0.0134533	3.95	0	0.026788	0.0795239
cons	-102	25.95771	-3.93	0	-152.8369	-51.08459
Mu						
cons	-1.211	4.046412	-0.3	0.765	-9.141468	6.720176
Usigma						
cons	-0.616	2.00553	-0.31	0.759	-4.547177	3.314356
Vsigma						
cons	-3.028	0.4881472	-6.2	0	-3.98451	-2.071008
Sigma_ U	0.7348	0.736796	1	0.319	0.1029421	5.244489
Sigma_ V	0.2201	0.537095	4.1	0	0.1363875	0.3550473
Lambda	3.339	0.7142104	4.68	0	1.939183	4.738837

Table No.3: Time Varying Technical Efficiency Mean Value of Rice Pakistan's provinces

1	Punjab	88%
2	Sindh	82%
3	Balochistan	81%
4	Khyber Pukhtunkhwa	51%
Overall	Pakistan	75%

Findings, conclusions and recommendations;

Findings: The study found that literacy rate, petroleum consumption, electricity consumption, credit availability, water availability, fertilizer and number of tube wells had significant effect on the rice production of Pakistan's provinces because their p values were less than .05 but the sign of credit availability and fertilizer coefficients were negative and showed inverse relationship. The coefficient signs of literacy rate, petroleum consumption, electricity consumption, water availability and numbers of tube well were positive, showed positive effect or positive relationship. The labour, arable land, irrigated land has no significant effect on the rice production of the four provinces of Pakistan because their p values were greater than .05. This study used time trend (years) for technological change which also had significant effect on the rice production. The second stage of the study which explain the effect of explanatory variables used in the study had significant effect on the dependent variable i.e. inefficiency. The study found γ value 0.92 which was near to one and showed that deviation from the production Frontier was due to inefficiency.

Conclusion: Agriculture is second best sector of Pakistan and also huge source of raw material for many agro based industries in Pakistan. The study examined effect of various inputs on the rice production of the Pakistan's four province's during the period 1980-2018. The paper examined that how much difference in the efficiency score of the different inputs used in the study as well as also checks the effect of technological change and efficiency of the inputs on the rice production of the Pakistan's provinces. Stochastic Frontier Analysis has been used to check the performance of agriculture sector. The different inputs have different effect on the rice crop, some has a negative effect and some has positive effect. The study used secondary data which is collected from the Bureau of statistic different publications. The data which is used in the study such as electricity consumption, petroleum

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consumption, credit availability, water availability, irrigated land etc, is not available separately for each crop. The study used aggregate data which is used in the production of agriculture sector. However this study provides a guideline to the policy maker and planner about the role of efficiency change and technological change on the rice production.

Recommendations: The results of stochastic frontier analysis shows that to improve the rice crop production of Pakistan's provinces that government should give due attention to the use of modern technology, as well also transfers technology and resources to all provinces equally. The government should improve market mechanism and provide relevant information to the farmers, which will be helpful in improving rice production. The legal frameworks should be developed by the government to encourage markets for exchanging agricultural production technology as well as resources and allow access to advance technology and resources from other province to backward provinces. In order to improve productivity the government should provide information about new production technology to the farmers and provide them trainings. These efforts may be results in generating technological change and also accelerate the catching up process in all over the country. While planning policies, characteristics of each region should be taking into account and for solution of this issue agricultural research station should be established in each region. One of the other factors which will be helpful in rice crop production is improvement in the management practices in order to increase the efficiency of the inputs used in the production process. To obtain the gains in the inputs efficiency of technical change more emphasis should be given to information and knowledge rather than the conventional inputs such as water fertilizer etc.

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