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INPUT COST AND OUTPUT PRICE RELATIONSHIP OF PADDY IN PANJAB STATE

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Abstract: Agricultural growth with stability has been a matter of concern in Punjab. As paddy is the major crop growing in the state, the present study was therefore carried out with the objectives to examine the changes in cost and Prices, growth, trend, parity between cost and Prices, gap between FHP (Farm Harvest Prices) and MSP (Minimum Support Prices), impact of MSP on area, production and productivity of Paddy in Punjab. The data of cost and Prices of Paddy were collected form the period 2000-01 to 2019-20 and analysed the temporal change, growth by using CGR (Compound Growth Rate), instability by using CV (Coefficient of Variation), trends by using linear and non-linear trend model, index number, effectiveness of the Prices policy during the harvest periods was examined by the deviations of FHP from MSP and classified into positive and negative deviations. These deviations calculated by using MAPD, MAND, AMPD and AMND formulas. To study the impact of lagged Minimum Support Prices (MSPs) on the acreage allocation, production and productivity, linear Regression equations have been fitted. The result shows that the temporal change of cost of Paddy crop increased subsequently over the period of time. This increase could due to increase in level of input use for Paddy is increases in Punjab. The growth analysis revealed that the growth in various cost of Paddy are found positively significant at 5 per cent level for overall period. For FHP and MSP of Paddy crop are found positively significant at 5 per cent level for overall period. The Coefficient of variation for various cost and Prices was found to be high in the Period-I and low in the Period-II, on the whole, it was observed that the degree of stability is increasing for over the period. There was an increase in trend in cost and Prices of Paddy during overall period and among the competitive parametric models

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third degree model are found best fitted based on R^2 significance. The gap analysis in which deviations of FHPs from MSPs of Paddy crop results in maximum negative deviations (MSP ruled higher than FHP) in Punjab. The result shows that previous year Prices influences current years' area, production and productivity of Punjab.

INTRODUCTION

Rice is a nutritional staple food which provides instant energy as its most important component is carbohydrate (starch). On the other hand, rice is poor in nitrogenous substances with average composition of these substances being only 8 per cent and fat content or lipids only negligible, i.e.,1 per cent and due to this reason it is considered as a complete food for eating. Rice flour is rich in starch and is used for making various food materials.

Paddy is the staple food for about half of the world population and more than two thirds of the Indian population. India ranks first in paddy area and second in paddy production next to China. In India, paddy is grown in about 44 million ha with the production of about 116 million tons of milled paddy. Paddy cultivation engages the most of the workforce in the economy as the source of livelihood for those people.

For higher growth of agriculture, quantitative assessment of the contribution of different factors of agricultural output growth is important for reorienting the programmes and prioritizing the agricultural development. Various factors affect the growth of agricultural output. Major ones of these factors are area and yield. These major sources of output growth have significance in finalizing programmes of agricultural development and priorities of investment in it. Hence, it may be vital to find why the growth rates different from one another, so as to remove the bottlenecks to achieve the fast development of agricultural sector.

Punjab is the third largest paddy producing state of the country only after Punjab and Punjab. Punjab produces about 12 million tons of paddy in about 3 million ha of area. It produces 11% paddy in 7% area of the country. Agriculture is the lifeline of state's economy as it provides employment to about two third of total workers of the state. Punjab is the pioneer state for various agricultural technologies and techniques but overall state is still lagging behind in various aspects of growth in production. The instability in area and production is quite common as per various institutes and reports in Punjab. Such fluctuations severely affect the production, and indirectly employment and income distribution are affected which there by hamper the economic growth of Punjab.

METHODOLOGY

The data was used for study is entire based on secondary source from Agriculture statistics at a glance. The data was collected from various government publications, and websites. Data from the previous 20 years was collected for the study and analysis from 2000-01 to 2019-20. The entire data was split up into two periods and overall i.e. period I: 2000-01 to 2010-11, period II: 2011-12 to 2019-20 and Overall: 2000-01 to 2019-20.

The study was undertaken to study the temporal changes in input use, cost and return of paddy. To estimate growth rates of input utilization and costs of paddy. To examine parity between cost and prices. To work out the impact of prices on area, production and productivity.

1.The growth rates were used to measure the past performance of the economic variable. The growth rates are used to examine cost and prices change over a period of time.

Growth rate was worked from using the following exponential function.

$$Y = a\, b^{t}$$

Where, Y= Cost/ Prices**,** T= time in years**,** b = regression coefficient**,** a = intercept

The compound growth rates 'r' was calculated by using the following formula

$$\textbf{CGR(r) = [Antilog (log b)-1]}\times\textbf{100}$$

Where, r = compound growth rates

2. To measure the instability in cost of cultivation and input utilization, an index of instability was used as measure of variability. The coefficient of variation (CV) will be calculated by the formula.

$$\text{C.V. (\%)} = \frac{\text{Standard deviation}}{\text{Mean}} \times 100$$

3. The factors affecting the cost of cultivation of paddy crops from the last 20 years was determined the differentials in costs of cultivation and Input use of crops. The significance level of changes in cost will be tested by 't' test.

The effect of cost of cultivation were explained to a certain degree by multiple regression analysis**.**

4. The behaviour of cost and prices of paddy for major states was studied by analysing the trend in the cost and prices of paddy for major states was worked out by fitting linear, quadratic, 3rd degree polynomial equation.

Table 1: Linear and Non Linear Trend Model

Model no.	*Model*	*Name of model*
1.	$Y_t=b_0+b_1t$	Linear equation
2.	$Y_t=b_0+b_1t+b_2t^2$	Second degree polynomial
3.	$Y_t=b_0+b_1t+b_2t^2+b_3t^3$	Third degree polynomial

5. An index number is a statistical measure design to show the changes in variables or group of related variables or group of related variables with respect to time.

The index number was calculated by choosing the 1^{st} triennium average as a base year.

$$\text{Index Number} = \frac{\text{Current Year Value} \times 100}{\text{Base Year Value}}$$

6. Factors affecting cost of cultivation was analysed by using multiple linear regression analysis. Multiple linear regression analysis is a statistical technique used to understand the relationship between multiple independent variables and a dependent variable. In the context of calculating the cost of cultivation, it can be employed to predict the costs based on various factors that influence cultivation expenses. The equation for multiple linear regressions can be represented as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \epsilon$$

Where:

Y = the dependent variable (cost of cultivation).

β_0 = intercept or constant term.

$\beta_1, \beta_2, \ldots, \beta_5$ = coefficients associated with independent variables $X_1, X_2 \ldots X_5$.

X_1 = Seed, X_2 = Fertilizer and Manure, X_3 = Human labour, X_4 = Animal labour

X_5 = Machin labour, X_6 = Plant protection, β = error term, representing the unexplained variability in the model.

7. The study was based on the farm harvest Prices and minimum support Prices is of major crops in India. To study the parity between the cost and Prices, the tabular analysis was used. To study the effectiveness of the Prices policy during the harvest period of deviation of farm harvest Prices from the MSP was worked out and classified into the negative and positive deviation to examine whether the market Prices ruled higher or lower over the MSP. Hence the absolute positive deviation (APD) or absolute negative deviation (AND)

and mean absolute positive derivation (MAPD) or mean absolute negative deviation MAND) calculated. Also adjusted mean positive deviation (AMPD) and adjusted mean negative deviation (AMND) was worked out.

$$\text{MAPD or MAND} = 1/n \sum | FHP_i - MSP_i |$$

If, FHP > MSP = Positive deviation (PD)

FHP < MSP Negative deviation (ND)

Where,

MAPD = Mean absolute positive deviation,

MAND= Mean absolute negative deviation,

FHP = Farm harvest prices,

MSP = Minimum support prices, and

n = Frequency of positive or negative deviations.

These deviations were adjusted with MSP in order to examine the degree of their deviation from the MSP. The formulae used for the adjusted mean negative/positive deviation was as follows:

$$\text{AMPD or AMND} = 1/n \sum (FHP_i\text{-}MSP_i|/MSP_i) *100$$

Where,

AMPD = Adjusted mean positive deviation, and

AMND = Adjusted mean negative deviation

The significance of gap between FHP and MSP of paddy for major states was tested by two sample t-test.

$$t = \frac{(x-y)-(u_x-u_y)}{\sqrt{\frac{1}{n_x}+\frac{1}{n_y}}}$$

Where, x= mean of FHP of size n_x, y= mean of MSP of size n_y, Sp^2= pooled variance

$$Sp^2 = \frac{(n_x-1)S_x^2}{(n_x-1)+(n_y-1)}$$

To study the impact of lagged minimum support Prices on the area, production and productivity of the paddy. Linear form of equation was used. The previous year MSP generally influence the producer farmer decision on a carrier location for the current year the linear.

1. Linear regression equation:
   a. $A_t = a + b\, Pr_{t-1}$
   b. $P_t = a + b\, Pr_{t-1}$
   c. $Y_t = a + b\, Pr_{t-1}$
2. Logarithmic regression equation:
   a. Log. $A_t = \log a + b\, Pr_{t-1}$
   b. Log. $P_t = \log a + b\, Pr_{t-1}$
   c. Log. $Y_t = \log a + b\, Pr_{t-1}$

Where,

A_t = Area of paddy crop at (t^{th}) period,

P_t = Production of paddy crop at (t^{th}) period,

Y_t = Productivity of paddy crop at (t^{th}) period,

Pr_{t-1} = Minimum Support Prices of major crops taken in per quintal at ($t-1^{th}$) period.

RESULT AND DISCUSSION

Temporal changes in input use, cost and returns of paddy

The Temporal changes in cost and Prices crop have been examined as a whole for Paddy. The temporal changes in cost and Prices were estimated form the period 2000-01 to 2019-20.

The temporal changes in cost of paddy in Punjab was presented in Table 2 shows the changes in the cost cultivation of Paddy in Panjab. The total cost of Paddy has gone up from Rs. 32883 per hectare in 2000-01, Rs.75297.8 per hectare in 2010-11 to Rs. 134185.1 per hectare in 2019-20 depicting an increase 228.99 per cent and 408.07 per cent during a period of study. The increase has occurred in Paddy of cost like hired human labour, family labour, bullock labour, machine labour, seed, fertilizer, farm yard manure, insecticide, rental value of owned land and interest on working capital, costs of interest on fixed capital and depreciation cost. The cost of human labour, family labour, machine labour, seeds, fertilizer, and insecticide has increased at a faster rate. Among total hired human labour (271.83 per cent) in 2010-11 and (440.71 per cent) in 2019-20 recorded the maximum share followed total family labour (218.40 per cent) in 2010-11 and (402.93 per cent) in 2019-20 followed by machine labour (187.71 per cent) in 2010-11 and (392.50 per cent) in 2019-

20 in the increase in cost of cultivation over time. Out of the total increase of 228.99 per cent and 408.07 per cent in the total cost of cultivation in 2010-11 and 2019-20. The items contributed about 204.60 per cent and 373.18 per cent and the remaining 245.50 per cent and 431.68 per cent by fixed cost items in 2010-11 and 2019-20 respectively.

Table 2 : Temporal changes in cost of Paddy in Punjab

Particulars		*Rs/ha*		*Percent charges over Base period i.e. 2000-01*	
	2000-01	*2010-11*	*2019-20*	*2010-11*	*2019-20*
Hired human labour	3857.42	10485.69	17000.14	271.83	440.71
Total family labour	1499.80	3275.57	6043.13	218.40	402.93
Bollock labour	16.98	110.49	18.58	650.71	109.42
Machine labour	2435.45	4569.14	9559.14	187.61	392.50
Seed	512.69	1263.59	1738.41	246.46	339.08
Fertilizer	1863.78	2848.31	3595.44	152.82	192.91
Manures	92.77	248.79	510.98	268.18	550.80
Irrigation charges	1139.37	2279.75	5624.54	200.09	493.65
Insecticides	1543.88	1451.54	4305.34	94.02	278.86
Interest on working capital	311.93	625.47	1140.82	200.52	365.73
Cost A	13274.07	27158.34	49536.52	204.60	373.18
Fixed costs	10512.44	27363.22	46168.56	260.29	439.18
Rental value	7795.36	17563.76	35089.98	225.31	450.14
Interest on fixed capital	1106.24	2922.32	2824.61	264.17	255.33
Depreciation	194.89	290.16	565.42	148.88	290.12
Land revenue	-	-	-	-	-
Cost B	19608.93	48139.46	84648.57	245.50	431.68
Cost C	32883	75297.80	134185.10	228.99	408.07

The increase in insecticide and fertilizer charges has been to the tune of 200.09 per cent, 493.65 per cent and 152.82 per cent, 192.91 per cent in 2010-11 and 2019-20 respectively, of the total increase in cost of cultivation. The percent changes over inputs in the cost of cultivation of Paddy at two points of time are also given in Table 3 the per cent changeover has remained around per cent in 2010-11, which was lower than that in 2019-20. Within the operational cost, the percent changeover. of machine labour in the total cost increased from 187.61 per cent in 2010-11 to 392.50 per cent in 2019-20 and the percent changeover of bullock labour in the total cost decreased from 650.71 per cent in 2010-11 to 109.42 per cent in 2019-20. The decrease

in the percent changeover of bullock labour is on account of substitution by machine labour. The percent changeover of fertilizer in the total cost increase from 152.82 per cent in 2010-11 to 192.91 per cent in 2019-20, for Paddy.

The extent of change in physical inputs and their prices along with changes in physical output and their prices and gross return for Paddy over time is given in Table 4.8. It is remarkable to note that the physical quantity of bullock labour, seed and manure has come down for Paddy due to increase in the wage rate of bullock labour and prices of manure, seed. Only physical quantity of fertilizer is increase and decrease in human labour due to increase in price of fertilizer and demand for human labour. The gross return for Paddy has recorded a 222.09 per cent in 2010-11 and 419.16 per cent in 2010-11 during the period study.

The increase in gross return from Paddy is attributable to the increase in the main and by-product of Paddy as well as increase in their prices over the years. It worth mentioning that the rate of increase in the prices of main product and by-product of Paddy has much higher compared to the increase in the physical yield of main product and by-product. The cost of production of Paddy has increased from 2000-01, 2010-11 and 2019-20 i.e. 386.29 Rs per quintal 836.46 Rs per quintal 1253.56 Rs per quintal respectively. While the cost of production has recorded 216.54 per cent and 324.51 per cent in 2010-11 and 2019-20 during the period being study.

Table 3: The extent of changes in physical inputs, input Prices, physical output, output Prices and gross return for paddy in Punjab

S.N.	*Particular*	*2000-01*	*2010-11*	*2019-20*	*Percent charges over Base period i.e. 2000-01*	
					2010-11	*2019-20*
A	Quantity of input					
1	Seed (Kg/Ha)	-	-	-	-	-
2	Fertilizer (Kg/Ha)	171.37	204.99	179.49	119.62	104.74
3	Manure (Qtl/Ha)	20.87	29.25	28.89	140.15	138.43
4	Human labour (hrs/ha)	444.68	771.44	324.92	173.48	73.07
5	Bullock labour (hrs/ha)	0.65	2.00	0.14	307.69	21.54
B	Prices of input					
1	Seed (Rs/Ha)	-	-	-	-	-
2	Fertilizer (Rs/Ha)	10.88	13.89	20.03	127.67	184.10
3	Manure (Rs/Ha)	4.45	8.51	17.69	191.24	397.53
4	Human labour (Rs/ha)	8.67	26.82	52.32	309.34	603.46
5	Bullock labour (Rs/ha)	26.29	55.12	137.02	209.66	521.19
C	Yield (Qtl/Ha)					

S.N.	*Particular*	*2000-01*	*2010-11*	*2019-20*	*Percent charges over Base period i.e. 2000-01*	
					2010-11	*2019-20*
1	Main Product	57.50	60.49	244.00	105.20	424.35
2	By- product	2.66	2.51	1.62	94.48	60.78
D	Prices of output (Rs/Qtl)					
1	Main Product	424.62	971.98	2160.99	228.90	508.91
2	By- product	34.29	65.11	129.38	189.91	377.36
E	Value of output (Rs/Ha)					
1	Main Product	30124.23	66313.44	126186.60	220.13	418.89
2	By- product	131.11	879.20	630.50	670.58	480.89
3	Gross Return	30255.34	67192.64	126817.10	222.09	419.16
F	Cost of production (Rs/Qtl)	386.29	836.46	1253.56	216.54	324.51

1.3.1.2 Temporal changes in Farm Harvest Prices of paddy

The results shown in Table 4 shows the changes in farm harvest Prices of paddy in Punjab. The increase has occurred form the year 2000-01 to 2019-20. Punjab and MSP shows 354.24 per cent ,190.74 per cent change during 2019-20 over 2000-01 respectively. Punjab shows the positive increase in farm harvest Prices of paddy.

Table 4: Changes in Farm Harvest Prices of paddy in Punjab

S.N.	*STATES*	*2000-01*	*2019-20*	*% change during 2019-20 over 2000-01*
1	Panjab	518	1835	354.24
2	Minimum Support Prices	540	1030	190.74

Growth rates of cost and Prices of paddy in Punjab

The rate of change in terms of various Costs of paddy in Punjab expressed in terms of compound growth rates estimated through exponential function were presented in Table 5

Table 5: Compound growth rate of cost of paddy in Punjab

S.N.	Particular	Period I	Period II	Overall
		2000-01 to 2010-11	**2011-12 to 2019-20**	**2000-01 to 2019-20**
1	Cost -A	5.76*	6.32*	6.82*
2	Cost -B	8.22*	6.07*	7.94*
3	Cost -C	8.12*	6.06*	8.03*
4	Cost of production	6.48*	4.12*	7.13*

Note: *= Significance at 5 per cent level

During the first period 2000-01 to 2010-11 (Period-I) the estimated compound growth rates were found to be significant for all the cost of Paddy is found to be satisfactory. Cost of production shows the positive and significant growth rate at 5 per cent level.

During the 2011-12 to 2019-20 (Period-II) all the costs of Paddy showed positive and significant growth rates at 5 per cent level. Cost of production shows the positive and significant growth rate at 5 per cent level.

In the overall period, all the costs of Paddy showed positive and significant growth rates at 5 per cent level. In general, it can be concluded that there was positive and significant growth rate during the period of study.

Instability of Cost of Paddy in Punjab

As seen from Table 6, that coefficient of variation of Cost-C for Paddy in Panjab was highest during overall period by 43.93 per cent. For period-l the coefficient of variation is highest for Cost-C i.e. 27.25 per cent. And for period-ll it is highest for Cost-A i.e. 19.02 per cent.

Table 6: Instability for cost of paddy in Punjab

S.N	*Particular*	*Coefficient of variation (CV)(%)*		
		Period-I	*Period-II*	*Overall*
1	Cost -A	21.27	19.02	39.11
2	Cost-B	27.23	17.62	42.93
3	Cost-C	27.25	17.49	43.42
4	Cost of production	24.00	12.70	39.29

Trends in cost and Prices of paddy in India

The trend equations were fitted to assess the cost and Prices of paddy crops in India. Depending upon its better fit, was analysed by the production model viz, linear, second degree and third degree polynomial equation trends results are assessed and presented under cost and Prices of selected crops.

Table 7: Trend in cost of paddy in Punjab

S. N.	*Particulars*	*Model*		*Coefficients*			
			R^2	b_0	b_1	b_2	b_3
1	Cost A	Third Degree Polynomial	0.97	11213.15	-0.73	70.76	192.04
2	Cost B	Third Degree Polynomial	0.99	22778.83	-10.58	399.23	-797.32
3	Cost C	Third Degree Polynomial	0.99	25493.63	-13.87	508.12	-1482.89
4	Cost of production	Third Degree Polynomial	0.97	443.54	-0.28	9.51	-37.96

For trend analysis of Cost-A of paddy (Table 7), maximum value of R^2 is 0.96 third degree polynomial trend is best fitted. In trend analysis of Cost-B, maximum value of R^2 i.e. 0.98 is best fitted for third degree polynomial trend. In trend analysis of Cost-C, maximum value of R^2 i.e. 0.98 is best suited for third degree polynomial trend. For trend analysis of cost of production, maximum value of R^2 i.e. 0.97 is for third degree polynomial trend which is best suited.

Index number

An index number is a statistical measure design to show the changes in variable or group of related variables with respect to time. The index numbers were worked out for the cost and Prices of paddy crop. The basic object of estimating index numbers was to make the trends in cost and Prices of selected crops. For this analysis the data pertaining to the year 2000-01 to 2019-20 i.e. last 20-year data were used. The results are presented in following tables.

In table 8 indicate that the highest increase in index number of Cost-A was (311.36) in the year 2019-20 and with lowest (85.46) in the year 2000-01. Index number for Cost-B was recorded highest (360.74) among all the cost from 2019-20 and with lowest (89.55) in year 2000-01. For Cost-C index number was (358.33) the highest value in 2019-20 and with lowest (88.95) in the year 2000-01. Cost of production has the highest index number of in 2019-20 (294.42) and lowest (90.73) in year 2000-01.

Table 8: Index number for cost of paddy in Punjab

(First triennium average as a base year)

YEAR	*COST A*	*COST B*	*COST C*	*Cost of production*
2000-01	85.46	89.55	88.95	90.73
2001-02	87.46	94.16	94.02	92.28
2002-03	127.08	116.29	117.03	116.99
2003-04	114.56	116.92	115.44	103.94
2004-05	120.79	127.82	126.69	105.37
2005-06	113.52	121.36	119.66	114.45
2006-07	108.98	122.60	121.16	112.13
2007-08	115.86	141.11	138.70	118.82
2008-09	151.51	183.55	180.61	157.33
2009-10	167.93	201.87	201.98	181.60
2010-11	170.55	206.61	204.49	196.46
2011-12	181.91	211.86	214.59	212.39

YEAR	COST A	COST B	COST C	Cost of production
2012-13	210.07	256.46	258.18	221.88
2013-14	222.43	271.31	272.69	245.03
2014-15	232.09	290.05	292.12	256.42
2015-16	233.24	149.00	271.57	249.35
2016-17	240.87	298.55	303.38	256.40
2017-18	255.84	321.78	324.51	254.25
2018-19	298.40	338.26	338.02	292.44
2019-20	311.36	360.74	358.33	294.42

Factors affecting cost of cultivation of paddy in Punjab

The multiple linear regressions were carried out between the independent variables and dependent variable. The independent variables that represent seeds, fertilizer and manure, human labour and bullock labour, machine labour and plant protection while dependent variable represent cost of cultivation of paddy in Punjab for overall period (2000-01 to 2019-20).

Table 9: Factors affecting cost of cultivation of paddy in Punjab

S.r. no	Variables	Coefficients	Standard Error	t Stat
1	Intercept	678.79	3060.60	0.22
2	X_1 (Seed)	4.70	5.97	0.79
3	X_2 (Fertilizer & Manure)	1.65	1.47	1.12
4	X_3 (Human Labour)	2.23	0.66	3.36
5	X_4 (Bullock Labour)	7.23	10.74	0.67
6	X_5 Machine Labour)	2.18**	0.77	2.84
7	X_6 Plan R^2 protection)	2.63	1.95	1.35
8		0.99		
9	F	536.06		

Note: **Significant at 5% level

Table 9 shows that the coefficient of determination (R^2) is used to measure how much the ability of the independent variable in explaining the bound variation. The coefficient of determination (R^2) obtained was 0.99. This means that 99 per cent variation explained by the studied independent variable while the remaining 1 per cent is influenced by other variable. Machine labour was found to be statistically significant at 5 per cent level.

Parity between cost and Prices

In this objective the gap between Minimum Support Prices (MSP) and cost of production of major crops and gap between the Farm Harvest Prices (FHP) and Minimum Support Prices (MSP) of paddy crop from 2000-01 to 2019-20 was studied.

Gap between Minimum Support Prices and Cost of cultivation of paddy in Punjab

The gap between Minimum Support Prices and cost of cultivation of paddy in Panjab is presented in the Table 10. The gap is calculated for the study period i.e. 2000-01 to 2019-20. The results revealed that the gap between MSP and cost of cultivation in Panjab recorded which ranged from 61.88 Rs/Qlt to 581.44 Rs/Qlt.

Table 10: Gap between Minimum Support Prices and cost of production of Paddy in Punjab

Year	*MSP*	*Cost of production*	*Gap*
2000-01	540	386.29	153.71
2001-02	560	392.91	167.09
2002-03	560	498.12	61.88
2003-04	580	442.56	137.44
2004-05	590	448.62	141.38
2005-06	590	487.28	102.72
2006-07	610	477.42	132.58
2007-08	675	505.92	169.08
2008-09	880	669.86	210.14
2009-10	1030	773.18	256.82
2010-11	1030	836.46	193.54
2011-12	1110	904.3	205.7
2012-13	1280	944.7	335.3
2013-14	1345	1043.27	301.73
2014-15	1400	1091.75	308.25
2015-16	1450	1061.66	388.34
2016-17	1510	1091.67	418.33
2017-18	1590	1082.54	507.46
2018-19	1770	1245.13	524.87
2019-20	1835	1253.56	581.44

Gap between Farm Harvest Prices and Minimum Support Prices of paddy in India

The gap between Farm Harvest Prices and Minimum Support Prices of paddy in Punjab markets of are presented in the Table 11 results revealed that the average gap between FHP and MSP of paddy in Punjab recorded was -136.30 Rs. /Qlt.

Table 11: Gap between Farm Harvest Prices and Minimum Support Prices of Paddy in Punjab

S.N.	STATES	FHP	MSP	Gap (MSP-FHP)
1	Punjab	1183.05	1046.75	-136.30

Deviations of FHPs from MSPs of paddy in Punjab

To examine the effectiveness of MSP policy for paddy in Punjab, difference between its FHP and MSP was calculated in different years and is given in Table 12 Panjab experienced positive deviations 14, times in 20 years during 2000-01 to 2019-20. This means that the average FHP was ruled higher than MSP in 14 times out of 20 years. The adjusted difference (positive) between MSP and FHP was low as 70 per cent of MSP and the negative difference was 30 per cent.

Table 12: Deviations of FHPs from MSPs of paddy in Punjab

			POSITIVE	*DEVIATION*		
S.N.	*STATE*	*Frequency*	*MAPD*	*Range*	*AMPD*	*Per cent*
1	Punjab	14	176	5-456	35.02	70
			NEGATIVE	**DEVIATION**		
		Frequency	MAND	Range	AMND	Per cent
1	Punjab	6	-88.33	(-1)-(-242)	-6.02	30

Impact of MSP on Area, production and productivity of Paddy on Punjab

The numerical values of the linear lag function for paddy indicates that R^2 is significant at 1 per cent level and supports the results that variation in Area of paddy is explained by the explanatory variable, i.e. previous year's minimum support Prices of the Paddy. Table no 13 revealed that 86 per cent variation in area 71 per cent variation in production 32 per cent variation in productivity of Punjab is explained by independent variable i.e. lagged MSP.

The elasticity for these variables is significant at 1 per cent level in case of area, production and productivity found as 0.38 per cent, 2.38 per cent, 0.47 per cent respectively indicating thereby that previous year Prices influences current year's area production and productivity of major growing State Punjab.

Table 13: Impact of MSP on Area, production and productivity of Paddy on Punjab

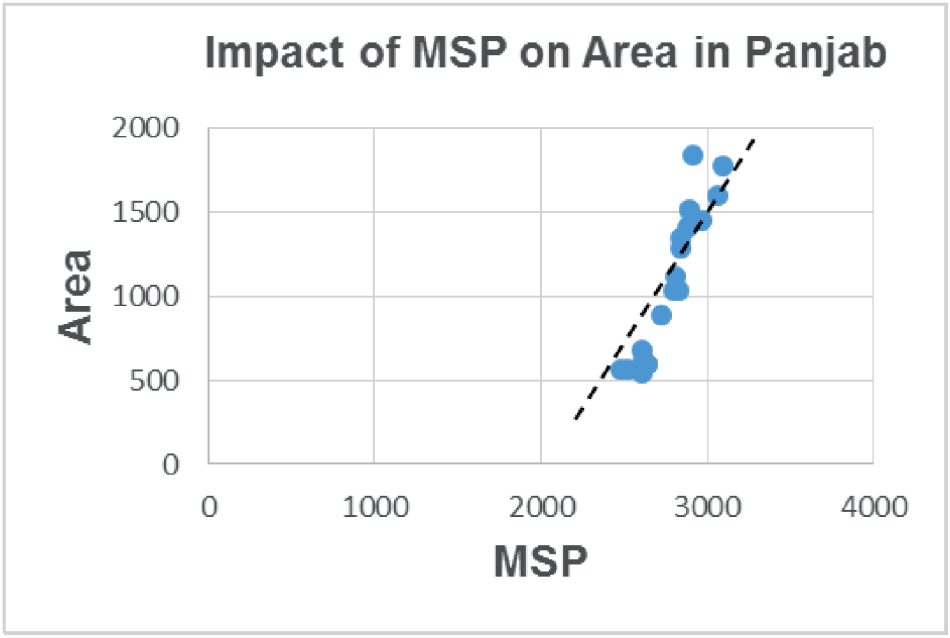
S.N.	*Variables*	R^2	*S.E. of R*	*Linear regression equation*
1	Area	0.86	68.11	$= A_t = 2398.75+(0.38)\ Pr_{t-1}$
2	Production	0.71	657.50	$P_t = 8488.55+(2.38)\ P_{t-1}$
3	Productivity	0.32	300.15	$Y_t = 3361.80+(0.47)\ P_{t-1}$

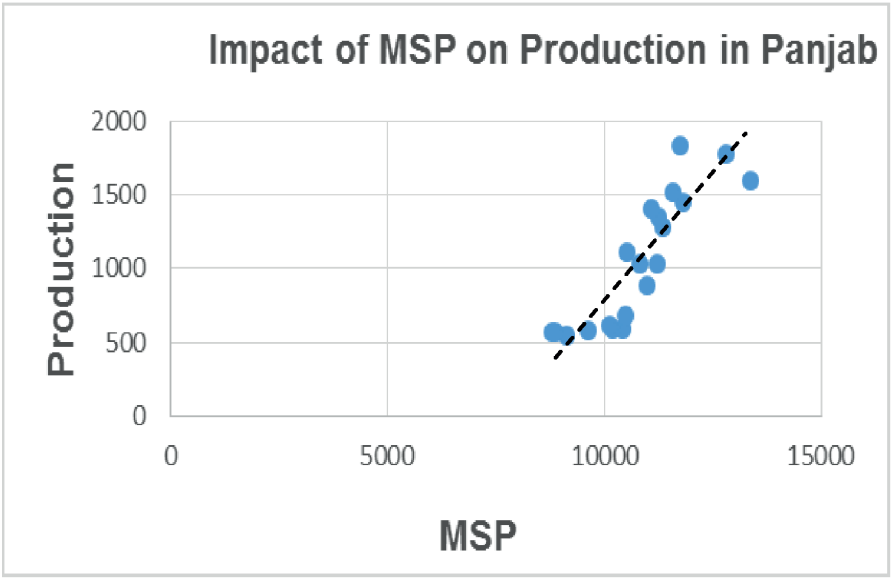
A_t = Area of paddy crop at (t^{th}) period,

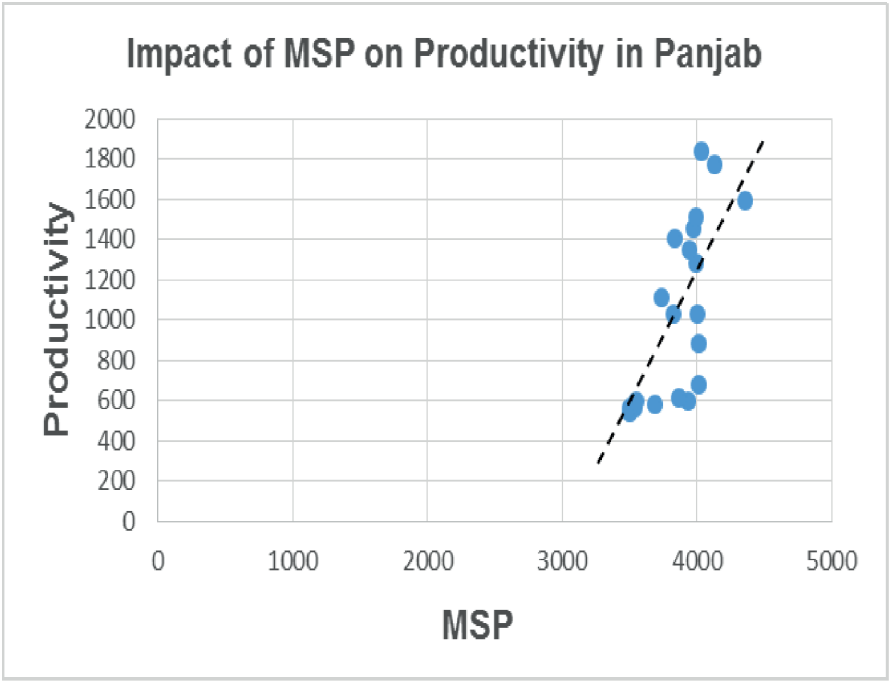
P_t = Production of paddy crop at (t^{th}) period,

Y_t = Area of paddy crop at (t^{th}) period,

Pr_{t-1} = MSP of paddy taken in Per quantal at ($t - 1^{th}$) period







CONCLUSIONS

The study of temporal changes, growth rate and trend enable one to indicate the general direction of change in Prices in different markets. To study the effectiveness of the Prices policy during the harvest periods, the deviations of

farm harvest Prices (FHP) from the Minimum Support Prices (MSP) were worked out and divided into positive and negative deviations to examine whether market Prices ruled higher or lower than the minimum support Prices. The negative deviations reflected ineffectiveness of MSP policy for producers. These deviations were adjusted with MSP in order to examine the degree of their departure from the minimum support Prices. By using linear and logarithmic regression equations we examined the impact of previous year Minimum Support on farmer decision on acreage allocation, production, productivity for the current year.

The total cost of Paddy in Panjab has gone up from 32883 per hectare in 2000-01 to 75297.8 per hectare in 2010-11 and 134185.1 per hectare in 2019-20 depicting an increase during a period of study. The increase has occurred in all major items of cost total manures 550.80 per cent and 296.60 per cent recorded the maximum share during percent change over in 2010-11 to 2019-20 respectively. The gross return for Paddy has recorded 419.16 per cent and 188.74 per cent form 2010-11 to 2019-20 respectively during the period study.

The compound growth rates of various cost revealed that, during overall period growth rates of cost were increasing significantly at 5 per cent level of significance. Among the cost the growth rate for Cost-C found highest increased significantly by 8.03 per cent during the study period followed by Cost-B, cost of production and Cost-A has found increased significantly by 7.94 per cent, 7.13 per cent and 6.82 per cent resp. during the study period.

Trend analysis of cost of paddy and Prices i.e. MSP and FHP for the overall period showed that, a wide range of models has been explored, among the competitive models the best fitted models are selected based on the R^2 significance. Among the competitive parametric models, almost all cases Third Degree Polynomial models are found best fitted; thereby indicating that the movement of all the series was uniform throughout the India. The gap between MSP and cost of production of Paddy in Panjab recorded which ranged from 61.88 to 581.44 Rs/Qlt. The highest gap was registered in year 2019-20 (581.44 Rs/Qlt).

Average gap between FHP and MSP of paddy highest gap was registered in Punjab State (130.85 Rs/Qlt). The impact of MSP shown by linear regression equation analysis. The State wise impact of MSP on the areas, production and productivity of paddy is explained by the explanatory variable, i.e., previous year's Minimum Support Prices of the paddy. The result revealed that 66 per

cent, 43 per cent and 25 per cent respectively, variation in Punjab state, Value of elasticity has found as -0.33, 1.90 and 0.72 respectively for area, production and productivity. The gap analysis in which deviations of FHPs from MSPs of Paddy crop results in maximum negative deviations (MSP ruled higher than FHP) in Punjab.

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