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Research Paper

COTTON ACREAGE RESPONSE TO PRICE IN THE PRE AND POST REFORM PERIOD IN POLLACHI MARKET CENTER OF TAMIL NADU STATE (PART A)

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ABSTRACT

A study of the nature and extent of the cotton acreage response to price changes in a select market centers of Tamil Nadu is important for a wide range of analytical as well as practical significance. Accordingly, the present study examines cotton acreage response to price changes in Pollachi market center of Tamil Nadu state. The results and interpretations of this study are based on two models namely, the adjustment lag model and the traditional model to obtain the response relation. The regressions relating acreage and other variables with alternative price specifications in Pollachi region during the study period reveal that it takes two years and five months for full adjustment (95 percent in the present study) for the acreage to change in its price.

KEYWORDS: cotton, market center, cropping, crop acreage, cotton flows

INTRODUCTION

Cotton production by and large can be increased by increasing area under cultivation, double cropping and raising yield of cotton by the application of new agricultural technology and by the reorganization of institutional factors. These factors differ considerably from region to region. Therefore acreage response is also expected to vary among regions. In recent years many attempts have been made to assess the growth of cotton production of Tamil Nadu state. This fact has prompted to use Nerlove's adjustment lag model and traditional model to examine that acreage responds to price and non price movements positively in Pollachi market center of Tamil Nadu state.

THE DATA

The study covers pre reform period (1971–72 TO 1989–90) and post reform period (1990–91 TO 2014–15) for which continuous time series data have been made available from the various issues of Government of Tamil Nadu. The estimating model included prices, lagged acreage, yield, rainfall, time trend and substitute

crop acreage as independent variables with acreage considered as a dependent variable. The effect of the above six independent variables on cotton acreage in this select region has been examined individually because it is not only the price but the quantum of other variables which are important for acreage allocation of cotton.

The results and interpretations of this analysis are based on two models, the adjustment lag model and the traditional model to obtain the response relation. Non-linear (logarithmic) regression equations have been fitted to the absolute values of the variables. The logarithmic functions gave consistently better fit and therefore for the study area, they were selected for discussion in this paper.

For Pollachi cotton market region a set of sixteen equations are presented. The first eight relate to the adjustment lag model using the first four price specifications namely, (a) Twelve - month annual average price in previous year (p_1), (b) Three - month



post-harvest average price in previous year (p_2), (c) Three - month pre-sowing average price in current year (p_3), and (d) Average of previous year's post harvest and current year's pre-sowing prices (p_4) with and without a trend value. The remaining eight are the equations based on the traditional model. In the traditional model with no recognition to past acreage, the first four prices are the same as used in the adjustment lag equations and the last four involve three year average price specifications namely (e) Three - year average of twelve - month annual average price (p_5), (f) Three - year average of three - month post harvest

average price (P_6), (g) Three - year average of three - month pre sowing average price (p_7) and (h) Three year average of three - month post harvest and three month pre sowing average prices (p_8). On the basis of these sixteen functions the best price expectation has been chosen for discussion.

ANALYSIS OF DATA

As a preliminary analysis simple zero order and first order partial correlations were worked out for Pollachi region for the variables used in this study and are given below.

TABLE - 1
ESTIMATION OF ZERO-ORDER AND FIRST-ORDER CORRELATIONS IN PRE-REFORM PERIOD (1971-72 TO 1989-90) AND POST REFORM PERIOD (1990 - 91 TO 2014 - 15)
 PRE-REFORM PERIOD POLLACHI POST REFORM PERIOD

	At	At_1	Yt_1	Wt	Tt	St		At	At_1	Yt_1	Wt	Tt	St
At	1.000	.818(**)	-.149	-.036	.777(**)	-.104	At	1.000	.841(**)	.066	-.542(*)	.807(**)	.603(**)
At_1		1.000	-.061	-.126	.840(**)	-.147	At_1		1.000	.110	-.476(*)	.685(**)	.569(**)
Yt_1			1.000	-.204	-.210	.376	Yt_1			1.000	.055	.184	-.200
Wt				1.000	-.244	-.264	Wt				1.000	-.619(**)	-.272
Tt					1.000	-.020	Tt					1.000	.479(*)
St						1.000	St						1.000

** Correlation is significant at 0.01 level. * Correlation is significant at 0.05 level.

TABLE - 2
ESTIMATION OF SIMPLE PRICE CORRELATION COEFFICIENTS IN PRE-REFORM PERIOD (1971-72 TO 1989-90) AND POST REFORM PERIOD (1990 - 91 TO 2014 - 15)
 PRE-REFORM PERIOD POLLACHI POST REFORM PERIOD

	P1	P2	P3	P4	P5	P6	P7	P8		P1	P2	P3	P4	P5	P6	P7	P8
P1	1.000	.905(**)	.916(**)	.970(**)	.841(**)	.895(**)	.888(**)	.894(**)	P1	1.000	.845(**)	.777(**)	.828(**)	.915(**)	.732(**)	.907(**)	.872(**)
P2		1.000	.714(**)	.873(**)	.489(*)	.553(*)	.541(*)	.548(*)	P2		1.000	.915(**)	.978(**)	.853(**)	.809(**)	.813(**)	.856(**)
P3			1.000	.941(**)	.894(**)	.958(**)	.931(**)	.947(**)	P3			1.000	.979(**)	.801(**)	.702(**)	.845(**)	.822(**)
P4				1.000	.838(**)	.900(**)	.891(**)	.898(**)	P4				1.000	.845(**)	.771(**)	.848(**)	.857(**)
P5					1.000	.961(**)	.988(**)	.979(**)	P5					1.000	.902(**)	.951(**)	.980(**)
P6						1.000	.986(**)	.996(**)	P6						1.000	.796(**)	.938(**)
P7							1.000	.997(**)	P7							1.000	.957(**)
P8								1.000	P8								1.000

** Correlation is significant at 0.01 level.

* Correlation is significant at 0.05 level.

In pre reform period the correlation between area and lagged area were positive in the study area. This association reveals that a substantial portion of acreage allocation in cotton flows from past behaviour. Equally surprising is the positive correlation found between area and trend in the study region. It was really unique, variables like rainfall and substitute crop acreage emerged with negative signs in Pollachi region. The relationship between area and time trend was positive in this market region.

In the post reform period, there was positive association between area and lagged area, area and yield, and area and trend value in Pollachi study region. Cotton acreage and rainfall emerged with a negative sign in this select region taken for the study. The relationship of area with substitute crop acreage had a mixture of positive and negative signs.

It may be mentioned that no definite indication could be obtained from the zero order correlations worked out for the acreage and non price variables as the association between them in the study area came to be neither uniform nor powerful, not significant enough to suggest any definite choice.

The extent and direction of association between the relative prices was attempted with the help of simple correlation coefficients. P_1 price showed a very good significant association with P_3 price in Pollachi, in pre and post reform periods. All values are positively correlated in the study area. Out of the eight price variables P_3 emerges significantly correlated with remaining price variables in this study area of Tamil Nadu.

Regressions were run for Pollachi district and the estimated acreage response function based on the selection of price for this district is given below.

TABLE - 3
ESTIMATED ACREAGE RESPONSE FUNCTIONS WITH DIFFERENT PRICE EXPECTATIONS USED FOR COTTON LINT PRICES IN POLLACHI IN PRE-REFORM PERIOD (1971-72 TO 1989-90) - LOGARITHMIC

Equation No.	Price Expectation used	Constant	Pt_1	At_1	Yt_1	Wt	Tt	St	R ²	Adj. R ²
1.01	P1	6.006	-0.274 (0.53)	0.326 (0.654)	0.481 (0.654)	0.27 (0.414)	0.465 (0.819)	-0.283 (0.597)	0.606	0.369
1.02	P2	4.455	-0.407 (0.417)	0.398 (0.398)	0.265 (0.672)	0.288 (0.400)	0.342 (0.72)	-0.004627 (0.666)	0.63	0.409
1.03	P3	4.215	-0.02213 (0.399)	0.312 (0.36)	0.465 (0.64)	0.27 (0.381)	0.725 (0.674)	-0.34 (0.572)	0.655	0.467
1.04	P4	4.209	0.04131 (0.512)	0.282 (0.404)	0.484 (0.663)	0.231 (0.436)	0.787 (0.774)	-0.359 (0.601)	0.595	0.353
1.05	P1	6.501	-0.476 (0.381)	0.495 ** (0.26)	0.293 (0.546)	0.253 (0.4)		-0.108 (0.495)	0.593	0.408
1.06	P2	3.849	-0.522 * (0.328)	0.555 *** (0.214)	0.03735 (0.456)	0.266 (0.383)		0.205 (0.481)	0.622	0.45
1.07	P3	5.075	-0.233 (0.35)	0.603 *** (0.239)	0.174 (0.583)	0.212 (0.379)		-0.144 (0.546)	0.619	0.46
1.08	P4	4.261	-0.275 (0.407)	0.595 *** (0.262)	0.142 (0.572)	0.238 (0.436)		-0.04485 (0.516)	0.554	0.351
1.09	P1	8.224	-0.194 (0.513)		0.845 ** (0.469)	0.265 (0.407)	0.96 ** (0.539)	-0.559 (0.482)	0.58	0.389
1.10	P2	7.561	-0.288 (0.400)		0.751 * (0.465)	0.278 (0.4)	0.941 *** (0.402)	-0.404 (0.532)	0.593	0.409
1.11	P3	6.702	-0.03484 (0.394)		0.823 * (0.482)	0.313 (0.373)	1.163 *** (0.440)	-0.602 (0.48)	0.631	0.478
1.12	P4	6.314	0.09707 (0.494)		0.799 * (0.475)	0.22 (0.425)	1.199 *** (0.489)	-0.597 (0.484)	0.576	0.383
1.13	P5	0.996	0.582 (0.98)		0.737 * (0.478)	0.112 (0.458)	1.617 ** (0.884)	-0.485 (0.502)	0.587	0.4
1.14	P6	3.897	0.256 (0.781)		0.765 * (0.491)	0.215 (0.414)	1.298 ** (0.613)	-0.503 (0.54)	0.578	0.387
1.15	P7	4.144	0.275 (0.807)		0.752 * (0.503)	0.19 (0.435)	1.365 ** (0.769)	-0.533 (0.502)	0.579	0.387
1.16	P8	3.827	0.282 (0.807)		0.756 * (0.497)	0.201 (0.423)	1.343 ** (0.697)	-0.513 (0.521)	0.579	0.387

* - Significant at 20% level ** - Significant at 10% level *** - Significant at 5% level **** - Significant at 1% level

Figures in the Parenthesis are standard errors

P1 – Twelve – month annual average price in previous year. P5 – Three – year average of twelve – month annual average price.

P2 – Three – month post harvest average price in previous year. P6 – Three – year average of three – month post harvest average price.

P3 – Three – month pre sowing average price in current year. P7 – Three – year average of three – month pre sowing average price.

P4 – Average of previous years post harvest and current year pre sowing prices.

P8 – Three – year average of three – month post

harvest and three-month pre sowing average price

TABLE - 4
FINALLY ESTIMATED COTTON ACREAGE RESPONSE FUNCTIONS - POLLACHI IN PRE REFORM PERIOD

Equation No.	Price Expectation Selected	Constant	Regression Coefficients						Coefficient of Multiple Determination R ²	Adjusted Coefficient of Multiple Determination R ⁻²
			Relative Price P _{t-1}	Cotton Acreage in A _{t-1}	Yield Y _{t-1}	Rainfall W _t	T _t	Substitute Crop S _t		
1.03	P3	4.215	- 0.02213 (0.399)	0.312 (0.36)	0.465 (0.64)	0.27 (0.381)	0.725 (0.674)	-0.34 (0.572)	0.655	0.467
1.11	P3	6.702	- 0.03484 (0.394)		0.823 * (0.482)	0.313 (0.373)	1.163 *** (0.440)	-0.602 (0.48)	0.631	0.478

* - Significant at 20% level

** - Significant at 10% level

*** - Significant at 5% level

- Significant at 1% level

Figures in the Parenthesis are standard errors

TABLE - 5
ACREAGE ELASTICITIES AND COEFFICIENT OF ADJUSTMENT FOR COTTON LINT PRICES IN POLLACHI IN PRE-REFORM PERIOD (1971-72 TO 1989-90)

Equation No.	Elasticity with respect to prices		Elasticity with respect to yield	Elasticity with respect to weather	Elasticity with respect to substitute crop	r	s	Coefficient of adjustment (x)	Years required for 95 percent effect of price
	Short run elasticity	Long run elasticity							
1.03	-0.015	-0.022	-0.019	-0.020	-0.037	6.13	- 0.0322	0.6880	2.572
1.11	-0.024	-0.024	-0.020	-0.022	-0.040	6.70	- 0.0348	-	-

SELECTION OF PRICE AND THE ESTIMATION OF ACREAGE RESPONSE IN POLLACHI PRE REFORM PERIOD

Table 3 gives the regressions relating acreage and other variables with alternative price specifications. Taking a general look at the regression obtained with all the four price specifications (equations 1.01 to 1.04) it is found that the co-efficient of relative price is positively significant in equation 4 (the average of post harvest and pre sowing price). Added to this lagged acreage, yield and rainfall have also turned out to be positive from 1.01 to 1.04. The inclusion of time T_t as another variable in these functions substantially alters the magnitude and significance of variables. It is found that substitute crop acreage shows negative significance. Between these four equations, equation 1.03 has the highest adjustment co-efficient of multiple determination. Among price variables without the trend, P₄ which was earlier significant does not show any

improvement. Regression co-efficients obtained for lagged acreage revealed the level of significance at 5% from 1.06 to 1.08 and 10% level for 1.05. The response of cotton acreage to yield and rainfall show the positive significance. Substitute crop acreage remains negative in all equations from 1.05 to 1.08 except 1.06. R⁻² remains satisfactory for P₃ price in the adjustment lag model and hence P₃ price is taken into account in the finally estimated cotton acreage response functions.

In traditional model the results do not support the generally expected positive supply price response relationship for all equations. P_{t-1} is negatively significant from equations 1.09 to 1.11. Yield, rainfall and time found to be positive and their level of significance have gone up from 20% to 1%. Substitute crop is found to be negative in all equations. R² value is high for P₃ price. Thus P₃ price has an edge over other prices in Pollachi district. (Table 4).

In order to provide an objective measure of response to price changes, estimates of elasticities for

acreage response functions calculated for different variables are given in Table 5. Both the models could with appropriate price specifications and with the inclusion of relevant non price variables prove to be equally efficient in regard to estimates of short run price elasticities of -0.015 and -0.024 respectively. The long

run elasticity is of the order of -.022 and -.024 respectively. The farmers in this district take about 2 years and 6 months to fully adjust to acreage to a change in its price. This suggests an explanation of the superiority of P_3 over the simple price.

TABLE - 6
ESTIMATED ACREAGE RESPONSE FUNCTIONS WITH DIFFERENT PRICE EXPECTATIONS USED FOR COTTON LINT PRICES IN POLLACHI IN POST-REFORM PERIOD (1990-91 TO 2014 - 15) - LOGARITHMIC

Equation No.	Price Expectation used	Constant	Pt_1	At_1	Yt_1	Wt	Tt	St	R ²	Adj. R ²
2.01	P1	-3.666	0.211 (0.652)	0.46 * (0.32)	-0.455 (0.37)	0.138 (0.441)	0.736 * (0.45)	0.483 (0.783)	0.90 4	0.857
2.02	P2	-5.651	0.751 * (0.526)	0.308 (0.247)	-0.704 ** (0.386)	0.05881 (0.412)	0.96 *** (0.332)	0.467 (0.714)	0.91 8	0.876
2.03	P3	-4.840	0.846 ** (0.459)	0.305 * (0.218)	-0.718 ** (0.356)	0.119 (0.389)	1.029 **** (0.312)	0.268 (0.687)	0.92 5	0.887
2.04	P4	-5.650	0.882 * (0.508)	0.281 (0.233)	-0.74 ** (0.37)	0.08194 (0.395)	1.034 **** (0.326)	0.365 (0.691)	0.92 3	0.884
2.05	P1	2.365	-0.686 ** (0.376)	0.896 **** (0.188)	-0.224 (0.363)	0.00706 3 (0.459)	-	0.51 (0.832)	0.88 3	0.838
2.06	P2	-3.777	-0.362 (0.449)	0.843 **** (0.205)	-0.0642 (0.396)	-0.237 (0.5)	-	0.903 (0.874)	0.86	0.806
2.07	P3	-5.143	-0.246 (0.421)	0.819 **** (0.203)	-0.0897 (0.398)	-0.318 (0.485)	-	1.017 (0.86)	0.85 7	0.802
2.08	P4	-4.423	-0.312 (0.444)	0.83 **** (0.203)	-0.0777 (0.397)	-0.275 (0.493)	-	0.963 (0.866)	0.85 8	0.804
2.09	P1	-12.007	0.943 *** (0.423)	-	-0.523 * (0.382)	0.0607 (0.455)	1.274 **** (0.259)	0.927 (0.748)	0.88 8	0.845
2.10	P2	-9.726	1.185 *** (0.404)	-	-0.835 **** (0.38)	0.01775 (0.416)	1.27 **** (0.224)	0.753 (0.69)	0.90 7	0.871
2.11	P3	-8.327	1.221 **** (0.385)	-	-0.813 *** (0.362)	0.07844 (0.401)	1.341 **** (0.226)	0.503 (0.69)	0.91 3	0.879
2.12	P4	-9.136	1.275 **** (0.397)	-	-0.851 *** (0.364)	0.0291 (0.4)	1.327 **** (0.222)	0.589 (0.677)	0.91 4	0.88
2.13	P5	-15.745	1.891 **** (0.602)	-	-0.623 ** (0.342)	-0.104 (0.407)	1.412 **** (0.241)	0.624 (0.681)	0.91 2	0.878
2.14	P6	-12.378	1.133 (0.945)	-	-0.538 (0.449)	0.07718 (0.525)	1.139 **** (0.286)	0.954 (0.858)	0.86 1	0.807
2.15	P7	-14.003	1.528 *** (0.524)	-	-0.578 * (0.35)	0.07285 (0.415)	1.347 **** (0.239)	0.65 (0.702)	0.90 6	0.871
2.16	P8	-14.957	1.743 *** (0.736)	-	-0.634 * (0.387)	0.04326 (0.45)	1.319 **** (0.262)	0.677 (0.762)	0.89 2	0.85

* - Significant at 20% level ** - Significant at 10% level *** - Significant at 5% level **** - Significant at 1% level

Figures in the Parenthesis are standard errors

P1 – Twelve – month annual average price in previous year. P5 – Three – year average of twelve – month annual average price.

P2 – Three – month post harvest average price in previous year.

P6 – Three – year average of three – month post harvest average price.

P3 – Three – month pre sowing average price in current year.

P7 – Three – year average of three – month pre sowing average price.

P4 – Average of previous years post harvest and current year pre sowing prices. P8 – Three – year average of three – month post harvest and three-month pre sowing average price



TABLE - 7
FINALLY ESTIMATED COTTON ACREAGE RESPONSE FUNCTIONS - POLLACHI IN POST REFORM PERIOD

Equation No.	Price Expectation Selected	Constant	Regression Coefficients						Coefficient of Multiple Determination R^2	Adjusted Coefficient of Multiple Determination \bar{R}^2
			Relative Price P_{t-1}	Cotton Acreage in A_{t-1}	Yield Y_{t-1}	Rainfall W_t	T_t	Substitute Crop S_t		
2.03	P3	-4.840	0.846 ** (0.459)	0.305 * (0.218)	-0.718 ** (0.356)	0.119 (0.389)	1.029 **** 0.312	0.268 (0.687)	0.925	0.887
2.11	P3	-8.327	1.221 **** (0.385)		-0.813 *** (0.362)	0.07844 (0.401)	1.341 **** (0.226)	0.503 (0.69)	0.913	0.879

* - Significant at 20% level ** - Significant at 10% level *** - Significant at 5% level **** - Significant at 1% level
Figures in the Parenthesis are standard errors

TABLE - 8
ACREAGE ELASTICITIES AND COEFFICIENT OF ADJUSTMENT FOR COTTON LINT PRICES IN POLLACHI IN POST-REFORM PERIOD (1990-91 TO 2014 - 15)

Equation No.	Elasticity with respect to prices		Elasticity with respect to yield	Elasticity with respect to weather	Elasticity with respect to substitute crop	r	s	Coefficient of adjustment (x)	Years required for 95 percent effect of price
	Short run elasticity	Long run elasticity							
2.03	0.758	1.091	0.743	0.831	1.438	-6.96	1.2173	0.6950	2.523
2.11	1.094	1.094	0.745	0.833	1.442	-8.33	1.2210	-	-

POST REFORM PERIOD

Table 6 gives the regressions relating acreage and other variables with alternative price specifications in Pollachi region in post reform period. It is found that P_{t-1} is positively significant in all equations from 2.01 to 2.04 with varying level of significance. In addition lagged acreage, W_t , T_t and S_t have also turned to be positive. Yield coefficients are negative at 20 percent level. In the adjustment lag model without the trend variable (T_t) equations 2.05 to 2.09 reveal that farmers are influenced by past acreage and substitute crop. Yield, rainfall did not do well in the acreage allocation decisions of the farmers. Again in this period P_3 price is substantially significant because equation 2.03 gives the best fit with highest R^2 and \bar{R}^2 values.

In the traditional model a positive price response was indicated from 2.09 to 2.16. Trend and substitute crop acreage turned out to be positive. Yield did not exert much influence on acreage. Rainfall shows both positive and negative signs for different price specifications. The highest position in terms of the nature of R^2 and \bar{R}^2 is maintained by P_3 and P_4 prices. (Table 6) In the finally estimated cotton acreage response function (Table 7) equation 2.03 gave a better R^2 value

with 70 percent variation in acreage due to P_3 price. Adjustment lag model along with traditional model gave short run price elasticities of 0.758 and 1.094 respectively. The long run elasticities are 1.091 and 1.094 respectively. All other variables are also positively associated with acreage as shown in Table 8.

CONCLUSION

In Pollachi district it takes two years and five months for full adjustment (95 percent in the present study) in Table 8. Thus the adjustment was seldom perfect. The study broadly endorses the conclusion that the adjustment lag model yields better results when compared with traditional model as it yields good values for the variables considered for the present study.

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